THE

AMERICAN NATURALIST,

A

POPULAR ILLUSTRATED MAGAZINE

OF

NATURAL HISTORY.

EDITED BY

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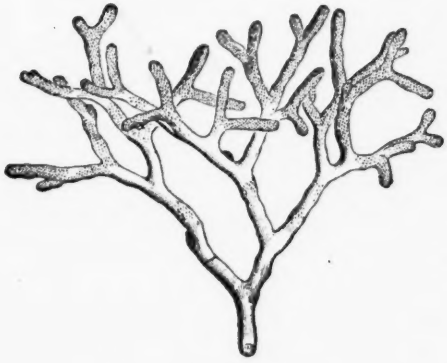
VOLUME II.



SALEM, MASS.
PEABODY ACADEMY OF SCIENCE.
1869.

ESSEX INSTITUTE PRESS.

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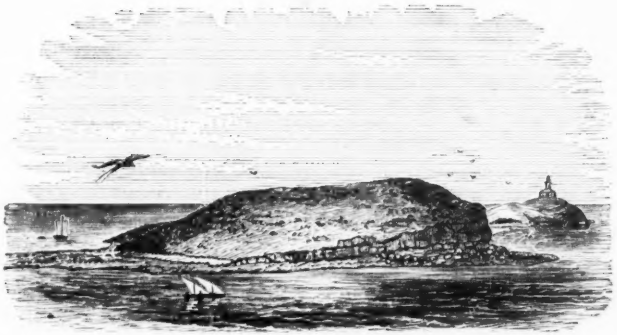
THE

AMERICAN NATURALIST.

Vol. II.—MARCH, 1868.—No. 1.

A NATURALIST IN BRAZIL.

BY C. FRED. HARTT.



SANTA BARBARA DOS ABROLHOS.

THE shore-line, where ocean and land meet, is rarely ever the edge of a continent. Both North and South America have a submerged border, in some places very wide, in others very narrow. Thus, off the coast of New England, the water does not deepen immediately at the shore-line, but the sea-bottom slopes off very gradually, sometimes, the water becoming ever deeper and deeper, until at a distance of many miles from the shore the true brink of the great valley occupied by the waters of the ocean is reached, and

thence seaward the bottom slopes rapidly down beneath the almost unfathomable depths of the ocean. The walls of the continent do not arise perpendicularly from the ocean floor; they slope, to give greater strength and stability to the structure. As a general rule we know that the water which borders a low coast is shallow for some distance out, the sea-bottom continuing under water with the same general slope as the land. New Jersey is a State whose coast-lands are low and flat, and we find that the sea-bottom bordering it grows very gradually deeper and deeper, in such a way that the true edge of the continent, or of the ocean, properly speaking, lies at a distance of about eighty miles from the land. Just such a submerged border runs along the coast of Brazil, in some places being many miles in width, in others reduced to a very narrow strip; and we find the general rule holds good here as elsewhere, that the deeper water along the coast lies off the highest hills, while the flat lands are bordered by shallow water.

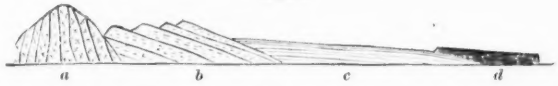
Professor Agassiz, in one of his New York lectures last winter,* showed how very strikingly alike North and South America are in their general and physical features. Not only is this true, but an examination of the eastern coasts of Brazil and the United States will show that there is a wonderful resemblance in the details of their geological structure. Thus, running all along the eastern coast of the United States, we find a range of mountains in which some of the oldest stratified rocks are upheaved, and on the eastern flank of these mountains, south of New York, are low lands occupied by more recent formations, thick beds of sandstone of the Triassic age and beds of marls, etc., of the Cretaceous; and over these, again, deposits of Tertiary and recent times.

I take a big Webster's dictionary, open it a little and

* Cooper Institute, February 5, 1867. In his lately published Journey to Brazil, Professor Agassiz has carried out this comparison between the two Americas to a much greater extent.

stand it on edge with the covers sloping like the eaves of a house. This book I place before me in such a way that the line of the back will point towards the north-east. This will represent the Alleghany Mountains. Now I take a thinner book and lean its back against the south-eastern side of the dictionary so that it will slope off to the south-eastward, but very much more gently than the covers of the dictionary. This second book will represent much newer strata, which recline against those of the Alleghanies. Among those in New Jersey are thick beds of a coarse red sandstone, the material out of which brown-stone houses are so commonly made in New York City and elsewhere. Geologists call this Triassic or New-Red Sandstone. These beds have been tilted up since they were formed. Now let us take another book, and lay its edge just on that of the one last laid down, so that it will lie almost horizontally and much lower than the rest. This will represent newer strata, marls, and sands, etc., of Cretaceous age, which lie still undisturbed in the same position in which they were laid down. Take another book, and lay it so that its edge will overlap that last laid down, and this will represent beds of sands, etc., which were deposited after the Cretaceous, and which geologists call Tertiary strata. These are also undisturbed, and in the same position as that in which they were deposited. As we go southward, the Triassic rocks disappear from view, and the Tertiary beds lap over the Cretaceous, so as to bury them completely. All this will appear more plain from the following figure, which is an

Fig. 2.

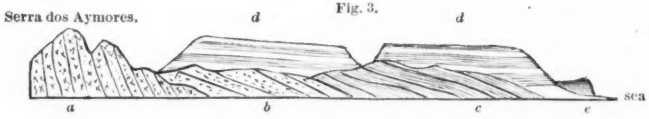


ideal section across the strata of New Jersey, from the mountains to the sea. *a* represents the upturned beds of gneiss, etc., of the mountains, against which lie inclined the Triassic, or New-Red Sandstone strata, *b*. Those marked *c* are Cre-

taceous, while *d* represents the latest deposited, or Tertiary beds. Now it is evident that the beds *a* are the oldest, and were the first disturbed. The Triassic rocks were deposited against them and slightly tilted up, and over these were laid down the beds of the Cretaceous and Tertiary.

If I make a similar section across the coast of Sergipe, a little province lying on the coast of Brazil just north of Bahia, from the gneiss hills to the sea, we shall find almost precisely the same structure, as is exhibited in the following section :—

Fig. 3.



a is the gneiss of the coast mountains, and is probably Azoic; *b*, beds of a coarse red sandstone, precisely like the Triassic, or New-Red Sandstone of New Jersey, and most probably of the same age; *c*, limestones and sandstones with fossils characteristic of the Cretaceous epoch, such as *Ammonites*, *Inoceramus*, etc., and *flint*. It is worthy of note, that whereas the Cretaceous strata of North America have suffered upheaval and folding only in the west, those of the eastern border of Brazil had been folded and disturbed prior to the deposition of the Tertiary strata *d*, which, occupying a higher level than on the east coast of the United States, everywhere lap completely over and bury the formations which occupy the lower grounds bordering the coast. Southward of New Jersey, as well as in the Mississippi valley, we also find the Cretaceous overspread by the Tertiary.

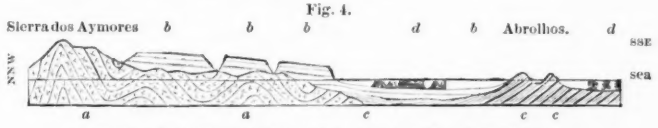
In this section *e* represents beds of sand containing shells, etc., of recent species, which have been raised above sea-level by the late, and probably now-continuing up-rise of the coast. Of this rising of the coast we have at Rio and elsewhere abundant evidence. One finds the nests excavated by sea-urchins in the rock, six feet or more above high tide-level. At Rio the upheaval amounts to about eight feet. In

North America the last great upheaval was greater in the north than in the south. Facts seem to show that in South America it was just the reverse.

About half-way between the cities of Bahia and Rio de Janeiro, and distant about forty miles from the mainland, there is a little group of islands, which, lying right in the way of navigation along the coast, and surrounded by dangerous reefs, have long been known as the *Abrolhos*, or "*Open-your-eyes*" Islands.

If we make a section across the country from the coast mountains, which separate the provinces of Minas Geraes and Bahia, to the sea, and then continue it to the Abrolhos, we shall have one like the following: —

Fig. 4.



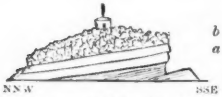
a, Gneiss; *b*, Tertiary strata; *c*, Cretaceous strata; *d*, Coral reefs.

In this section the New-Red Sandstone and Cretaceous beds do not appear on the main-land, at least so far as I have seen, and usually, as on the river Mercury, we find the Tertiary clays and sandstones lying immediately over the gneiss. But at the Abrolhos Cretaceous rocks appear, for the islands are seen to be composed of beds of shale, sandstone, etc., similar in character to those of the Cretaceous farther north. These islands stand about in the middle of the submerged border of the continent, which is here at least seventy miles wide. This submarine shelf is overspread by Cretaceous rocks, which, at the Abrolhos, have been broken and uplifted so as to form a little group of islands.

The Abrolhos consist of four principal islands, and two little islets. These are arranged close together in an irregular circle. All are quite high, the height of the principal one, Santa Barbara, being 33.22 metres (about 109 feet). This is the largest, and is three-quarters of a mile in length. On its

summit is a very fine light-house, whose attendants, three men, are the only human inhabitants of the islands. The strata composing this island are inclined to the N. N. W., approximately, at an angle of 10°–15°, so that the island has a slope to the northward, while on all other sides it is precipitous. The surface is mainly composed of a bed of trap, which is spread out over the other rocks, as is seen in Fig. 5.

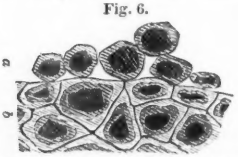
Fig. 5.



Section across island of Santa Barbara, Abrolhos. *a*, Shales and yellow Sandstones; *b*, Trap.

It is a wonderful thing to see how rocks decompose and rot away in Brazil. Even gneiss and slate grow soft to a depth sometimes of even a hundred feet. This trap-bed at the Abrolhos is decomposing also, but this takes place in a very interesting way. The trap, which is a very hard and heavy dark-bluish rock, is cracked up on the surface into angular pieces of all sizes, as represented in Fig. 6.

Fig. 6.



If the rock were smooth and unbroken on the surface, it would decompose only on the upper surface, but water soaks in through these cracks, and each fragment decomposes all around, so that a concentric coating of rotten rock is formed (Fig. 6, *b*), which may afterward be removed by rains. Thus each piece loses coating after coating like the layers of an onion, becoming ever more rounded in form as this goes on, until at last the surface of the bed is covered over with rounded boulder-like masses, often resembling cannon balls (Fig. 6, *a*). Nearly the whole surface of the island of Santa Barbara is covered by these rounded masses of trap.

The vegetation of the island is very scanty, and, save a *Siriba* on the island of that name, to which bear company two dwarf cocoa palms, trees there are none. Several species of coarse grass abound, and give sustenance on Santa Barbara to a herd of many hundreds of goats. There are some thickets of dwarf mimosas, and a few ferns, etc.

The land animals consist of lizards, of three or four species, which are considerably numerous. Insects are few, and the principal representative of the class is an immense hairy spider (*Mygale*), of a species very common on the coast. This spider, which the Brazilians call *Aranha caranguejia*, or *crab-spider*, has a body sometimes as big as an egg. It exists in countless numbers, living under stones. Almost every loose stone has one of these monsters under it. The bite from its long fangs is very painful and poisonous. It preys on lizards, and has been known to kill young chickens, and suck their juices.

Sea-birds resort here by myriads, at certain seasons of the year, to breed. Among these there are several species of gulls, pilots, and the magnificent frigate-bird. To these birds and their habits we may, perhaps, by and by devote a special paper.

It is in the waters of the vicinity, however, that the greatest riches of animal life are to be found. Fish, of an incredible number of species, are wonderfully abundant, and a regular fishery is carried on here from the town of Porto Seguro for a giant perch called the *Garoupa*, which fish is however cured so badly as to be scarcely eatable.

In the month of May, a species of whale (*Megaptera*) makes its appearance on this coast in considerable numbers. It is furnished with whalebone, and has on the back a hump of fat which looks very much like a fin. Above, it is black in color; below, usually white, or light-colored, and marked by longitudinal furrows, which are especially conspicuous under the throat. Along the lower jaws there is a number of round lumps, or tubercular masses of fat, as large as one's fist. The pectoral fins are long, narrow, and irregular along the edges. This whale grows to be thirty to forty feet in length.

Among the first to make their appearance at the commencement of the season are large females (*Madrijos*), bringing with them their little ones but just born. The

whalers say that they resort to the islands and reefs for protection. The males are not so numerous, nor are they so valuable to the whaler. I once saw a female swimming with its calf. The latter swam close alongside its mother, following all the motions of the latter, and coming up to breathe at the same moment. The whalers all told me that the female holds out her fin obliquely, and that the little one swims with its head between it and the body. They denied that this whale ever clasped the young under the fin. This species is very lively and difficult to catch, notwithstanding which a small fleet of boats stationed at Caravellas captures every year some thirty to seventy whales, which afford a large quantity of oil. These two fisheries, that of the *Garoupa* and whale, deserve attention on the part of American fishermen, as they might be developed so as to become very profitable. The whales leave the coast in the latter part of September or in the early part of October. They occur also all along the Brazilian coast, but Bahia is the only other place at which they are systematically fished. Considerable numbers are caught here every year, and, during the season, one may sit at his breakfast at the restaurant in the hotel in the upper town, and watch the pursuit and capture of one of these monsters in the bay, almost under his very window.

It has long been known that the waters of the Abrolhos and vicinity were made very dangerous to navigation by extensive reefs, which covered large areas just outside of the islands, as well as between them and the main-land. In the descriptions of the Brazilian coast in the various "Coast Pilots," both English and foreign, that I have seen, very conflicting statements are made with reference to these reefs, some saying that they are composed of coral, others of decomposed gneiss; and the different kinds of reefs are confusedly described, so that it is not easy to distinguish, from these descriptions, reefs of rock, reefs of coral, or solidified beaches, like that of Pernambuco, which last, being separated from the land by the washing away of the loose sand of the

upper part of the beach, as well as from behind, are left standing like walls of sandstone running parallel to the coast. In scientific books it is generally stated that there are no coral reefs on the coast of Brazil.

While engaged in the late Thayer Expedition under Professor Agassiz, in company with Mr. Edward Copeland, the writer discovered some quite extensive reefs in the bays of Santa Cruz and Porto Seguro, and made out, in a general way, their structure. Fishermen and pilots described the reefs of the Abrolhos as precisely like those at Porto Seguro, and a note in a chart of Lieutenant Mouchez, which afterwards fell into the writer's hands, left no doubt of the existence of extensive coral reefs in that region. The return of the Expedition left no time for their exploration, but the writer, during his visit to the Brazilian coast last summer, gave them a careful examination.

Many species of polyps grow along the coast of Brazil, even as far south as Cape Frio, and the bay of Rio offers a few insignificant coral building species, principally an *Astrangia* or two, which form scattered cells on dead shells or stones. There is at Rio quite a number of species of soft-bodied polyps, of the order of the *Sea-anemones*, and some of these are very beautiful. In the same bay representatives of the highest order of polyps, the Halcyonoids, are not numerous. The most interesting is a species of Renilla (*R. Danæ* Verrill),* a curious "family" of polyps, in which all the bodies of the animals are joined together, and clustered on one side of a leaf-like expansion, to which there is a single appendage like a stem, by which the whole moves about like a single individual.

South of Rio de Janeiro there appear to be few polyps which have calcareous skeletons; but on the rocky shores northward a few species soon begin to become quite common.

*I am indebted to the kindness of my friend, Professor Verrill, for the determination of the Radiates mentioned in this paper.

In the rocky tide-pools of Os Busos, Guarapary, Victoria, Porto Seguro, etc., to Bahia, we find them quite abundant. There is a massive kind growing in rounded, flattened lumps or patches on the rocks belonging to the genus *Siderastræa*.* It has small, close-set cells, and grows in masses often a foot or more in diameter, and occasionally several inches in height, encrusting the rocks. With this there occurs a little, irregularly globular coral, an inch or two in diameter, and with large, irregular, crowded cells, in which the radiating plates are very conspicuous (*Favia*, like *ananas* Edw. and Haime). In deeper water we find a large *Acanthastræa* (*A. Braziliensis* Verrill)† growing sometimes in round heads a foot or more in diameter, together with large bouquet-like masses, often a foot across, of a beautiful coral (*Mussa Harttii* Verrill),‡ whose branches, thick and long, are cylindrical, forking, radiating from the same point, and with the cells at the ends of the branches large and deep. There are several other species of hard limestone building

* *Siderastræa stellata* Verrill sp. nov. Corallum forming rounded or hemispherical masses, often flattened above. Cells polygonal, rather large (about .15 inch) deep, the central part rapidly descending. Septa in four cycles, those of the first two cycles considerably broadest, all of them evenly crenulated, rather thin, thickness less than the intervening spaces, slightly projecting, the inner edge evenly rounded. Columella inconspicuous, represented only by one or two tubercles. Wall between the cells represented by a simple line. Trabicular processes between the septa very distinctly seen from above. Differs from *S. radians* in having larger cells, which appear more open; thinner septa, and consequently wider intervening spaces, and four complete cycles of septa. — A. E. V.

† *Acanthastræa Braziliensis* Verrill. A large species, forming hemispherical masses a foot in diameter; margin of base surrounded by a strong epitheca; cells large, varying from .3 to .7 of an inch in their largest diameter, but mostly about .5 inch, irregularly polygonal, often much elongated, and then having two or more centres, moderately deep (.15 inch), centre depressed, columella but little developed. Septa thin, in five cycles, the last usually incomplete, projecting subequally, the upper part divided into from three to five long, sharp teeth, below which the teeth are smaller and more slender. Walls between cells sometimes single, often double with vesicles between. — A. E. V.

‡ *Mussa Harttii* Verrill. A beautiful species, forming large clumps with rather small branches, and simple, subcircular cells. Branches rapidly dividing, mostly .5 to .8 of an inch in diameter, the living part extending from .2 to .5 of an inch from the summits, and often surrounded by an imperfect epitheca, covered with strong, subequal costæ, with numerous sharp, nearly equal, recurved spines. Cells from .5 to 1.2 inches in diameter, subcircular, often irregular, with waved margins, rather deep (.4 to .5 inch). Septa in five cycles, thin, subequal at summit, where they project about .1 of an inch, the upper part divided into from four to seven unequal, sharp, diverging teeth, with

corals. *Millepores*,* corals often with flat, ragged-edged branches, like the antlers of an elk, and with very small pores like pin-holes, are not uncommon.

In many localities south of the Abrolhos district, these corals grow quite abundantly, but I have no evidence that they ever form reefs or banks. Reef-building corals, according to the best authorities, flourish only at depths less than one hundred feet. They also require a warm temperature of the water. The great shelf of the Abrolhos lies over a very large area, at a depth of less than a hundred feet, and the conditions for the growth of corals are of the most favorable kind. In consequence of this, we find here not only around the islands, but in the shoal, open waters, very extensive reefs and banks, which, in an area of fifty miles square, occupy a space of nearly one hundred and fifty square miles.

When the tide goes out, there is seen extending around about one half the island of Santa Barbara, as is shown in the illustration at the head of this article, a fringing reef of coral, out on which one may walk, as on a low wharf at high tide, and from its ragged edge look straight down through the limpid green water, and see the sides of the reef and the sea-bottom covered with huge whitish coral-heads, and a wealth of curious things not easily to be got at.

The surface of the reef is quite flat, and rises but a short distance above low-water mark. It is rather irregular, and is overgrown with barnacles, shells, mussels, and serpula-tubes, and overspread with large slimy brownish patches, of

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smaller teeth below. Columella slightly developed, consisting of slender, loosely arranged, contorted processes.—A. E. V.

*The most abundant species is *Millepora nitida* Verrill. A very distinct species, forming low, rounded clumps, four to six inches in diameter, consisting of short, rapidly forking, rounded, or somewhat compressed branches, about .4 to .8 inch in diameter, which have a remarkably smooth surface, and are obtuse, rounded, or even clavate at the ends. The larger pores are small, very distinct, round, evenly scattered over the surface, at distances of about .06 to .1 of an inch apart. The small pores are minute, numerous, scattered between the large ones, and often showing a tendency to arrange themselves around them in circles of six or eight. The tissue is more compact and firmer than in *M. alcicornis*.—A. E. V.

a soft-bodied, encrusting polyp (*Corticifera*), of a leathery color.

The reef abounds in small pools, some of which are shallow and sandy, others deep, rocky, and irregular. The former often contain scattered corals, *Siderastræa* and *Favia*, and are rich in small shells, crabs, *Ophiuræ*, etc., but the latter are the most interesting.

Fancy, my reader, a pool of the purest sea-water held in an irregular rock-basin a few yards across, full of little grottoes and niches, and three or four feet deep. Carpet this pool with white coral sand and broken shells, and tapestry heavily the sides with soft fringes and curtains of delicate, brilliant-hued sea-weeds. Plant here and there on the rocks clumps of corals and sprigs of *Gorgoniæ*, and down deep in this shady corner place a big hemispherical Astræan. Here among the sea-weeds, and just out of reach of the sunbeams, let us plant two or three softly-tinted sea-anemones, just where the translucent, tender, petal-like tentacles of these sea-flowers will be best shown off. And we must not forget to stock our aquarium with a plenty of sea-urchins, pincushiony little monsters, bristling all over with long dark purple spines (*Echinometra Michelini* Desor), and each nestled comfortably away in a cavity worn in some incomprehensible manner in the solid rock. Here is a little crimson star-fish (*Echinaster*);* let us half hide him in under the sea-weeds, for it won't do to make him too conspicuous; and here are some queer crabs, that go restlessly prying about among the sea-weeds, frightening the sea-anemones, and, perhaps, falling a prey to a snaky-armed cuttle-fish, that lurks under some dead coral. Now we must introduce a

* *Echinaster crassispina* Verrill. Rays short, somewhat angular. Radius of disk .5 of an inch; of rays 1.9. Spines along each edge of the ambulacral grooves in two rows, the outer ones large and sharp, crowded, those on opposite sides crossing one another, a single one on each plate. Spines of inner row much smaller, not half as long, one to each plate. Lower side of ray with a row of distant, large, conical, sharp spines, not extending upon the disk. On back and side of rays there are four or five other irregular rows of similar large, sharp spines, rising from the swollen nodes. It has shorter and more angular rays, coarser structure, larger and fewer spines than *E. spinosus* of West Indies.

swarm of little, gaily-painted, gilded and silvered fishes, and a crystal jelly-fish; a host of little shells, half of them tenanted by hermit-crabs, and swarms of little crustaceans. Now we will wreathe in among the sea-weeds, here and there, the necklace-like, pearly body of a marine worm, and we shall then have an aquarium, wonderfully like those which nature has so liberally strewn over the surface of the Brazilian coral-reefs.

Under the dead corals one finds great numbers of a large *Ophiura*, with a small disk-shaped body, and long snaky arms (*O. cinerea* Lyman), and by dint of a little patient examination, with the aid of a pocket lens, he may collect hundreds of species of animals from one of these pools alone. At the Abrolhos Islands, I found a few specimens of a large, almost pentagonal starfish, which is very common in the West Indies (*Oreaster gigas* Lütken). This also occurs at Bahia, together with a very well-known West Indian shell, quite common as a mantel-piece ornament, and which has the misnomer of *Cassis Madagascarensis!*

The corals, which go to make up the Santa Barbara reef, are principally *Acanthastræa*, *Heliastræa*, *Siderastræa*, *Favia*, *Porites*, *Millepora*. The reef-rock, like that of the reefs, is a compact, hard, white limestone, which appears to show scarcely any organic structure. The corals are so broken and cemented together, that their structure is quite obliterated. The Santa Barbara reef, then, forms a wharf-like structure, partially surrounding the island. It has grown upward as far as possible, *i. e.* to a level a little above that of low tide, when the corals having died, further growth is stopped. It varies much in width, but in some places it reaches even 400 feet. At the south-west extremity of the island there is a little islet, composed of a pile of boulder-like masses of trap, and known as the "Cemetery," which at low tide is united to the main-land by this reef. A reef of the same kind is formed around part of the neighboring island of Redonda, and Siriba also has one.

THE GEOGRAPHICAL DISTRIBUTION OF ANIMALS.*

BY SIDNEY I. SMITH.

It is one of the ever-wise provisions of nature, that every land has a vegetation and an association of animals peculiar to itself, that every sea and every zone of ocean is peopled with life found nowhere else. There is such a wealth of conception in the forms of organic life, that there is no need of their repetition in distant lands. The palms and the reef corals never wander from the tropics; the humming-birds are as peculiarly American, as the Mississippi or the Andes. It is specially the province of modern science to explain the phenomena of nature on known natural laws and forces, and with this view no phenomena are more interesting than those of the geographical distribution of species. The subject, in its full extent, would involve a solution of the much-vexed question of the origin of species; but whether species now living were derived from their relatives of a former geological age, or were independently created, we will not question in the present article, only taking species when they first appeared as they now exist, and contenting ourselves with some of the more prominent forces which bind them to peculiar habitats, or tend to diffuse them over wider or different areas.

These secondary causes, which act in the geographical distribution of species, are either inorganic or organic. Of the former the most important are the influences of topography, temperature, ocean currents, winds, and humidity; of the latter, animals themselves, and man,—for in this respect man must be separated from the mere brute animals as wielding a very different influence. The inorganic forces are so interwoven, they so act and react upon and limit each other, that

*"The Influence of Secondary Causes in the Geographical Distribution of Animals;" one of the subjects assigned for essays for the Berzelius prizes in the Sheffield Scientific School of Yale College in 1867.

they can scarcely be treated singly, and their influences are therefore discussed together; but the laws which govern the distribution of animals in the ocean are so different from those which govern the distribution of land and fresh-water species, that they are best treated separately.

The influence of topography in limiting the diffusion of marine species is too evident to require much explanation, and yet, uncombined with the influence of temperature, it would have little effect; for it is hardly possible to imagine a limit to the migration of species along coast lines and around capes from ocean to ocean, were the temperature of the water perfectly uniform. Still the mere separation of coasts by long intervals of deep water seems to have a direct influence in preventing the migration of certain groups of species; as, in the Pacific Ocean, under the same lines of temperature,* there are many species, especially of fishes and polyps, which are peculiar to each of the great groups of islands.

The influence of temperature has long been recognized as a most powerful cause in limiting the diffusion of marine species. Animals, with very few exceptions, are adapted for life and reproduction only within fixed limits of temperature, and a rise above or a fall below these limits, quickly puts an end to their existence. Such limits of temperature act as a continual check upon the effects of ocean currents in transporting species from place to place. Thus the Gulf Stream, flowing from the warm coral reefs of Florida and the Bahamas, must bear myriads of life-germs to the Bermudas and on across the Atlantic toward the Azores; but the isocrymal line of 68° F., which limits, on both sides of the equator, the reef-building corals† and most of the tropical

*The fact should not be overlooked that these isothermal and isocrymal lines indicate only surface temperature, and as there is yet very little known of deep ocean temperature, that it is quite possible that some species are retarded from descending to a sufficient depth to pass from place to place by the decrease in temperature; still the number of species must be small that can exist, even with the same temperature, at very different depths. (*Isothermal* is used to express equal annual temperature; *isocrymal*, equal temperature for the coldest month of the year.)

†Dana, United States Exploring Expedition, Vol. I, Zoöphytes.

marine species,* passes just north of the Bermudas, and all the germs of tropical life that cross this line must perish. The marine fauna of the West Indies extends to Bermuda, but, arrived at the Azores, the winter temperature has fallen to less than 60° F., and we have the fauna of the Mediterranean and none of the characteristic Bermuda species. On the other hand, in the Pacific, where the equatorial current flows continuously within the isocrymals of 68° north and 68° south, there are many species of mollusks, crustaceans, and echinoderms found from the Sandwich Islands to the coast of Africa, or through half the circumference of the globe.

The mere intervening deep ocean, without connecting islands, might prevent the occurrence of some of the Bermuda species at the Azores, as in the corals, the young of which probably cannot exist very long without becoming attached; but even along continuous coast lines, very few species extend through marked changes of temperature. On the western coast of America, a large part of the mollusks, crustaceans, echinoderms, and some polyps, extend from Lower California to Guayaquil and a few to Paita, Peru, but very few species are common to Guayaquil and to Callao, only a few hundred miles farther south. The isocrymals of 62° to 68° F. all converge near Cape Blanco, and such a change in temperature prevents the interchange of species between places north and places south of this point.†

The insular faunal character of the Americas has been remarked by many naturalists,—most of the marine species of

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*Among the Crustacea, excluding the little known Entomostraca, Dana found, out of 1,036 species in the faunal torrid zone and 924 in the temperate zone, only seventy-five common to the two.—U. S. Expl. Exp., Vol. XIII, p. 1527. As the range of species becomes better known, the proportional number of species common to the two zones will undoubtedly be increased, but the fact is sufficient to show the great influence of temperature in limiting the diffusion of marine species.

†Many of the Peruvian, and some Panamic species, are found at Paita, and as usual there is a blending of the two faunæ at their junction; but this blending does not extend a great distance along the coast, and is what would be expected from the warm waters overlapping the colder. If there are species which have their centre of greatest development and abundance near the border of a fauna, it is nothing more than might be expected from the effects of temperature,—such species being adapted to a temperature intermediate between that of two faunæ.

both coasts belonging to peculiar American types,—and yet the shores of America are connected by zones of equal temperature with the Central and Western Pacific, and with the eastern shores of the Atlantic. How is this peculiar American character preserved? What prevents the interchange of species, if temperature is the great cause which limits their distribution? A glance at the ocean currents shows that none of them leave our shores without undergoing a marked change in temperature, and that none, from other shores, arrive upon them without undergoing a similar change. The Gulf Stream, after leaving the coast of the Southern States and the Bermudas, changes its temperature from 68° F. to 60° before its southern outflow reaches the Azores, and to almost 50° before it arrives on the shores of Europe. The Atlantic equatorial current is formed off the coast of Africa by the union of the returning Gulf Stream, flowing from Southern Europe and the Azores, and the northern current flowing from Cape Good Hope. These currents flow directly from temperate coasts into the torrid zone, which, by their influence, is narrowed down, on the western shores of Africa, to 20° of latitude, while on the American shores it extends through 60°. The antarctic current from Cape Horn flows northward into the warmer waters of the southern Atlantic. The antarctic polar current of the Pacific comes north from the frigid regions of the south into the temperate waters, is bent eastward against the shores of South America, and the principal branch flowing north along the coast is turned westward from Cape Blanco or Punta Parina, and, under the equator, still retaining the low temperature of the southern waters, sweeps into the torrid regions beyond the Galapagos. The current, flowing from the north along the western shores of the United States, leaves the coast of California and flows southward into the tropics. The frigid regions of North America are, of course, excepted, and the arctic American partake strongly of the character of the arctic species of the old world.

How beautifully these material forces act, binding each species to a special home, from which it may not wander and live. Nature places the bounds, the ocean waters may sweep by, but they cannot bear along the life which throngs them. These inorganic causes alone constitute the limits of faunæ, and can it be doubted that faunæ really exist in nature, when it is fully understood that all their modifications and complications are results of revolutions in these causes themselves? Let us look at some of these revolutions,—changes in topography, in temperature, and in ocean currents,—for thus far we have seen only how the diffusion of ocean species is limited by secondary causes.

We should begin when the first species of the present faunæ began to appear, and trace the changes to the present; but the data are very imperfect, and we can get only glimpses of these changes, yet enough to indicate some of the effects they have produced in the distribution of species. There is some uncertainty how far back in geological time species now living may have existed, but most authorities agree that at least a few of the present marine species were living in the Tertiary period, when Europe was scarcely more than an archipelago, when the lower Mississippi valley was a part of the Gulf of Mexico, and while Florida and the whole border of the southern Atlantic States were still swept by the waters of the ocean. But these few recent species were not then in their present homes; they have wandered, like the early races of men, southward.

The European fossil land faunæ and floræ indicate very clearly a change of climate from tropical to temperate during the Tertiary period, and in the marine climate there was a similar change. On the western shores of France, along the vallies of the Loire and the Ardour, there are deposits of early Tertiary mollusks and echinoderms, a large part of them extinct or unknown species, but a small part at least are still living in the Atlantic Ocean. These species are not, however, now found on the coast of France, but eight

or ten degrees farther south on the coast of Africa, and all the species of these ancient deposits partake of what is now a more southern character.*

During the Tertiary period there was a gradual but very extensive elevation of the northern part of the continents. It was during this period that the Alps and the Pyrenees were raised to their present level. The lifting at the north of such masses of land into the cooler regions of the atmosphere would have had a powerful influence in reducing the temperature of the neighboring seas. As the waters became slowly cooled, the species best adapted to migrate gradually extended their limits southward; on the north, the species were destroyed by the advancing cold, and all those species with little power of migrating, and those easily affected by changes of temperature or other physical causes were wholly exterminated. And thus, on the shores of Africa, still exist the remnants of the ancient Tertiary fauna of the southern European seas, driven from their former home by the advancing cold, but living on through all the changes, even of a Glacial epoch.

In North America, the land climate during the early and middle Tertiary was warmer than now, as is indicated by the plants of the lignite beds, and the marine climate undoubtedly corresponded with that of Europe and with that of the land. In the northern parts of the country no fossil records of the later marine Tertiary are known, but the land faunæ of the period, the upheaval of the northern parts of both countries, and the changes in the European seas show very clearly that there were similar changes on the American shores.

The arctic marine fauna of the earlier Tertiary, while much more land than now was submerged at the north, must have been circumpolar in character, and the retreating of species southward from this common point accounts for the occurrence of the same species on the northern coasts of both

*Forbes, Natural History of the European Seas.

continents. Even those few species which are common to the temperate regions of both oceans or the shores of both continents, and not now found in the intermediate northern regions, may have been driven in the same manner southward, until the intervening continent or ocean left the remnants of the old circumpolar fauna widely separated in more southern regions. Why call to the aid of modern theories the mythical Atlantis to bear species across the ocean, when known climatic changes can have led them gradually from a common home at the north?

The marine fossils of the latest Tertiary of Europe, and doubtless of North America also, are very largely living species;* and at that time, the climate of the North Atlantic was nearly like that of the present. In the absence of any knowledge of fossil deposits contemporaneous with the earlier Glacial period, it is impossible to arrive at any definite conclusions in regard to the geographical distribution of the species at that time.† Still, the number of species which continued to live on through the Glacial epoch, the absence of well marked and extensive glacial phenomena from middle latitudes, and the appearance, in the decline of the Glacial period, of species near their present habitats, are good negative evidence that there was no very extensive southern migration of marine life during that period.

Darwin, in the "Origin of Species," supposes the cold of the Glacial period sufficient to have driven the species from the arctic and from the antarctic to the equator, and thus accounts for the similarity of the living species of those regions. Such intense cold would have been sufficient to destroy all life in the North Atlantic; and it can scarcely be supposed that species would travel from far north to the

* Lyell gives the proportion of living species of shells found in the Norwich Crag, in England, as ninety per cent. or more.—Principles of Geology, Amer. Edit., p. 143.

† A careful investigation of the later Tertiary of the Southern States, and its comparison with the Post-tertiary, would throw much light upon the extent of the disturbances in the geographical distribution of species in the North Atlantic during the true Glacial epoch.

equator and back again without leaving some traces behind them. Nor are the faunæ of the arctic and of the antarctic so closely allied as has sometimes been supposed. There is no well-authenticated instance of the same animal species occuring in each of the frigid latitudes, except such as have an intermediate or cosmopolitan existence.*

As Dr. Packard† has shown, the submerged beaches give very good evidence that the boreal and arctic regions of North America during the true Glacial epoch, stood at a much higher level above the sea than at present. This elevation was undoubtedly enough to raise the submerged border of the continent, the Gulf of St. Lawrence, the Banks of Newfoundland, and the banks off the coast of Nova Scotia, Maine, and Cape Cod, above the sea-level. As the rise and enlargement of the lands at the north during the Tertiary period had changed the climate of Europe and the northern parts of North America from tropical to temperate, this elevation during the Glacial epoch must have changed the climate of these regions from temperate to frigid, and brought the snow line down to the coast of New England. Such an enlargement of lands at the north would not, however, change materially the climate of the tropics, and it is altogether probable that the Gulf Stream flowed on and warmed the southern coast as it did in the Tertiary and does now, and that the coral reefs of Florida and the West Indies were then slowly building beneath its warm waters.

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* Professor Lilljeborg, in a recent paper (noticed in the NATURALIST, p. 48), in the Trans. Scientific Soc. at Upsala, on the *Lysianassa Magellanica* Milne Edwards, and on some other Crustacea of the suborder Amphipoda, on the coast of Sweden and Norway, while admitting that no species had previously been found common to both frigid zones and not in intermediate localities, claims to have discovered, in a gigantic Amphipod living upon the coast of Norwegian Finmark, the *Lysianassa Magellanica* of Milne Edwards. Bate has shown, however, in the Zoölogical Record for 1865, p. 330, that the arctic species is not only specifically distinct from the *Lysianassa* of Milne Edwards, but that it cannot be referred to that genus. Such facts show how very difficult it is to prove the identity of animals from far separated localities, without a direct and careful comparison of specimens, and how little confidence can be placed in the reported identity of such animals.

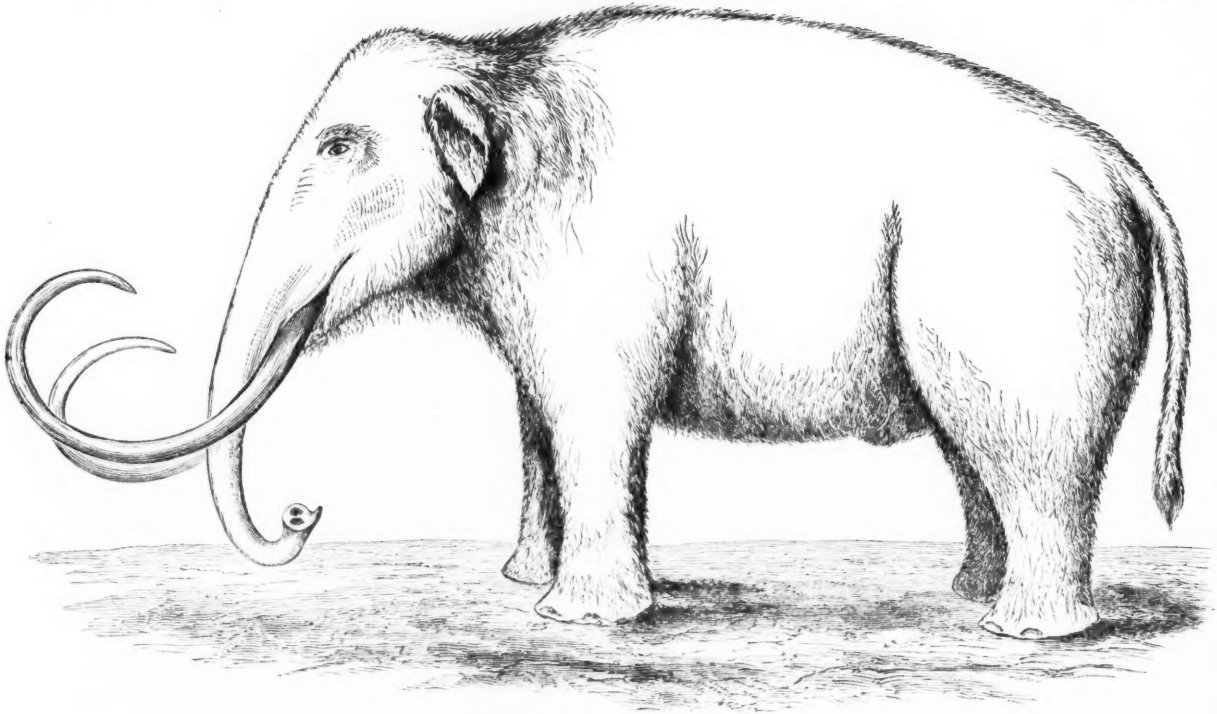
† Observations on the Glacial Phenomena of Labrador and Maine. Memoirs Boston Soc. Nat. Hist., Vol. I, Part II. Many of the facts, on several succeeding pages, are drawn almost wholly from this very interesting paper.

The sinking of the lands which closed the true Glacial epoch, carried the coast line higher than it is now, as is shown by the fossil deposits of the Leda Clays (Champlain epoch), found along the coast and far up the lower vallies from Labrador to New York. It might at first be supposed that such a depression would induce a climate even warmer than the present; but a depression of six or seven hundred feet would have made islands of New England and Nova Scotia, and opened a way for the Labrador current from the Gulf of St. Lawrence into the Bay of Fundy and along the coast of Maine, and, at the same time, would have allowed a branch of the current to flow up the valley of the St. Lawrence River into Lake Champlain, and very likely down the valley of the Hudson. Such a surrounding flood of arctic waters would have reduced the summer temperature of the land, and carried the arctic marine species somewhat south of their present limits.

The species left fossil in the Leda beds confirm this, and show very accurately the distribution of marine life at the time these beds were formed. The species of the earlier Labrador beds are more purely arctic than the present fauna of that coast.* The beds of fossils at Portland and Saco indicate that the Syrtensian fauna extended into the mouth of the ancient Casco Bay, as it now does into the mouth of the Bay of Fundy. At Point Shirley, in Massachusetts Bay, the species of the Leda beds belong almost exclusively to the Virginian fauna, which is now found only south of Cape Cod.† This shows that a branch of the Gulf Stream flowed over the eastern end of Long Island, and across submerged Cape Cod, into Massachusetts Bay. Thus, since all, or nearly all the marine species which now inhabit our coast were in existence, arctic species extended into southern Maine, and species, now living only south of Cape Cod, extended north to Cape Ann. The southern outliers of the Syrtensian

*Packard, loc. cit., p. 234.

†Stimpson, Proceedings Bost. Soc. Nat. Hist., Vol. IV, p. 9, 1851.



THE HAIRY MAMMOTH.

and Acadian faunæ, on the deep water-banks off the New England coast, are thus shown to be relics of the northward migration of these faunæ. — *To be concluded.*

THE HAIRY MAMMOTH.

BY A. S. PACKARD, JR., M. D.

In 1799, Schumachoff, a Tungusian hunter, discovered at the mouth of the river Lena a shapeless mass frozen in the ice. But not until two years after, 1801, when the ice had so melted that the tusks and one side of the animal were disclosed, did he know upon what a monster he had stumbled. Returning to his home on the borders of Lake Oncoul, he told his family of the strange creature entombed in the ice. They were seized with consternation, for in the days of yore some hunter had found on this peninsula the same sort of animal, and his family had all died soon afterwards.

Death, however, did not invade the household. The god of mammon reigned instead. On recovering from the nearly fatal sickness into which his superstitious fears had thrown him, our enterprising ivory-hunter, led on by the greed of gain, revisited the Mammoth Golgotha, and in March, 1804, favored by the warm weather, beheld the gigantic carcass, now become historic, reposing free from its icy tomb on the sands of the Lena. He sold the tusks for fifty roubles, and the carcass was left to the tender mercies of the people about, who fed their dogs on the flesh, while "wild beasts, such as white bears, wolves, wolverenes, and foxes also fed upon it, and the traces of their footsteps were seen around." The skeleton remained entire, except one foreleg, which some unusually enterprising white bear probably lugged off. Professor R. Owen, whose account we have been using, states that,—

"According to the assertion of the Tungusian discoverer, the animal was so fat, that its belly hung down below the joints of the knees. This mammoth was a male, with a long mane on the neck; the tail was much mutilated, only eight out of twenty-eight caudal vertebræ remaining; the proboscis was gone, but the places of the insertion of its muscles were visible on the skull. The skin, of which about three-fourths were saved, was of a dark gray color, covered with a reddish wool, and coarse long black hairs. The dampness of the spot where the animal had lain so long had in some degree destroyed the hair. The entire skeleton, from the fore part of the skull to the end of the mutilated tail, measured sixteen feet four inches; its height was nine feet four inches. The tusks measured along the curve nine feet six inches, and in a straight line from the base to the point three feet seven inches.

"Mr. Adams collected the bones, and had the satisfaction to find the other scapula, which had remained, not far off. He next detached the skin on the side on which the animal had lain, which was well preserved; the weight of the skin was such that ten persons found great difficulty in transporting it to the shore. After this, the ground was dug in different places to ascertain whether any of its bones were buried, but principally to collect all the hairs which the white bears had trod into the ground while devouring the flesh, and more than thirty-six pounds' weight of hair was thus recovered. The tusks were purchased at Jatusk, and the whole expedited thence to St. Petersburg; the skeleton is now mounted in the museum of the Petropolitan Academy."*

The Mammoth (*Elephas primigenius* Blum.), did not dwell alone in Siberia. A hairy Rhinoceros (*Rhinoceros tichorhinus*), which had a length of eleven and one-half feet, was found frozen in Siberia near Wilui in 1777. It ranged from England and Middle Europe to Siberia. Like the living species of elephants, the Mammoth not only browsed on the leaves of the spruce and fir, but ground beneath the broad surfaces of its immense grinders boughs of considerable thickness. It has been objected, despite its hairy coat, fitting it for the rigors of a Siberian winter, that the Mammoth could not have been indigenous to the shores of the Arctic Ocean, since the vegetation was so scanty; but Professor Owen sets aside such objections, observing that "forests of hardy trees and shrubs still grow upon the frozen soil of Siberia, and skirt the banks of the Lena, as far north as latitude 60°. In Europe, arboreal veg-

*Owen's British Fossil Mammals and Birds.

etation extends ten degrees nearer the pole, and the dental organization of the Mammoth proves that it might have derived subsistence from the leafless branches of trees, in regions covered during a great part of the year with snow."

We may, with this learned author, assign the northern limit of trees, which even at some points reaches the seventieth parallel of latitude, as the bounds to the wanderings northward of the Siberian Mammoth. A few years previous (1796), Cuvier announced that the bones of elephants found scattered through the Quarternary deposits, or Post-tertiary sands and clays, and the upper Tertiary deposits, belonged to a distinct, as well as extinct species. This fact suggested to him the idea of the existence of former worlds and successive creations of species, and from this moment the science of Palæontology took its place in the sisterhood of sciences. The bones of the Mammoth and the mastodon, the rhinoceros and hippopotamus were shown to belong to extinct species which formerly roamed over the surface of Southern and Middle Europe, and not, as his opponents contended, of luckless inmates of Roman menageries, or less likely, as others alleged, of heathen giants sixty feet high, who lived in the age of fable.

Organized research, led by the great French Palæontologist, established the fact that the Mammoth was indeed once an abundant animal in Europe. This huge elephant, with its cousin, the mastodon (*Mastodon angustidens*), a still larger genus of elephants, differing in the structure of the teeth, was common in Middle and Southern Europe; the species of both genera, like the elephants of the present day, enjoying a wide geographical range. The Mammoth ranged from the fortieth to the sixtieth parallel of latitude.

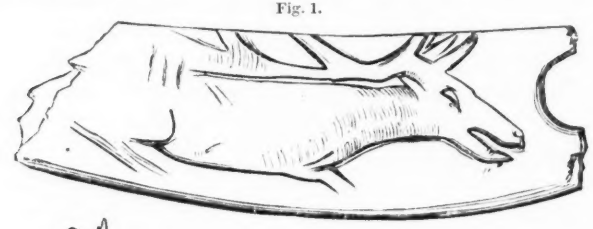
Lartet, one of the founders of a new science, *Anthropology*, has brought forward additional proof of the former existence in Middle Europe of the Siberian Mammoth, and that from the most startling sources.

In May, 1864, this French geologist, with his countryman

Vernueil and an English naturalist, Dr. Falconer, visited the caves of Perigord in the department of Dordogne, France, and discovered, in the soil and debris in the bottom of these caves, various sketches of animals carved on pieces of deer's horns and elephant's ivory.

We copy from an account of the discoveries made by Lartet and Christy (prepared by the great Danish naturalist and archæologist, Professor J. Steenstrup, for a Danish Natural History Journal, published at Copenhagen),* drawings that rival in interest the Rosetta Stone, specimens of Egyptian and Assyrian sculpture, or the remains of Aztec art. Fig. 1

Fig. 1.



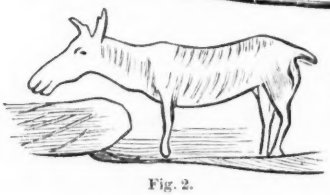


Fig. 2.

Fig. 3.

represents a species of deer, probably the reindeer; Fig. 2 an elk, allied to our moose; and Fig. 3 unmistakably pictures the head of the wild boar. The reader may puzzle over Fig. 4, but let him compare it carefully with the restoration of the Hairy Mammoth (*Elephas primigenius* Blumenbach, Plate 1),† which has been recently published by the Russian naturalist Brandt, from which our drawing is a little re-

* Tidsskrift for populaere fremstillinger af Naturvidenskaben, Udgivet af C. Fogh og C. F. Lütken. 3d ser., Vol. IV, Kjöbenhavn. See also our account of these discoveries, Vol. I, p. 274, taken from the Quarterly Journal of Science, London.

† Figure of a Hairy Mammoth engraved on a piece of elephant's ivory, found in the Madelaine Cave in the department of Dordogne, France. Taken from a photoxylo-

Fig. 4.

Figure of a Hairy Mammoth engraved on a piece of elephant's ivory, found in the Madelaine cave.

duced, and lo, an off-hand sketch of his trophy of the chase by some prehistoric Cummings or Baker!

As specimens of earliest art they are certainly creditable, and almost rank with drawing of animals represented in Assyrian, Egyptian, or Aztec art, at least surpassing the hieroglyphics of the North American Indians. The peculiar shape of the head of the Siberian Mammoth, with its characteristic up-curved enormous tusks, and trunk hanging down at ease, and the hairy mane, which no living species of elephant possesses, evince a quick eye, excellent perceptive powers, and an artistic touch given by the prehistoric artist, which certainly discovers the germs of dawning art in the Cave-dwellers of France.

From portions of several skulls and a single lower jaw of man found in the caves and gravel-beds of Europe, anatomists of high authority have, we cannot but think too hastily, referred their possessors to the most degraded of savage races.*

The bas-reliefs and inlaid sketches of our cave-dwellers, rather ally them, from the evidence of their art-remains, as a very high authority, Professor Steenstrup suggests, to the tribes of Eastern Asia. He states that Chamisso, the Italian

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graphic copy, published in the Danish Popular Journal of Natural History, reduced one half, from Lartet's original drawing.

About the same time the Marquis Vibraye discovered, on the banks of the Vésère in Dordogne, another engraving of the Mammoth made in a slab of slate. In speaking of the accuracy of the sketches he says, "The artists of the Augerie have made no caricatures, and dealed little in the fanciful. If the rough sketches of art in its first steps seem to us rude, the truthfulness of the general forms are shown to be at least scrupulously respected. I will cite as an example a slab of slate on which there is reproduced with a few strokes a combat of the reindeers. The victor is represented in an attitude the truthfulness of which is surprising. It is the same with an engraving of the head of the reindeer obtained also in one of the stations of the Augerie. In view of such facts it seems to be inadmissible to suppose, that, in making a purely fanciful drawing of a head, an aboriginal should have precisely reproduced that of an elephant, by the side of which we have constantly found the remains in the same conditions of burial; and that blind chance had been a sufficient guide for him to give in his sketch all the characters of a proboscidian of whose existence he was ignorant."—Annales des Sciences Naturelles, 5e ser. T. 4, p. 361. 1865.

* Maligned as these primitive folk have been by certain savants and popular-science writers, the unkindest blow of all has been dealt by the Rev. D. I. Heath in the London Anthropological Review, April, 1867. Readily accepting the supposed ape-like form of this race, he gravely propounds the theory that the "Kitchen-middeners" were *mutes*,

traveller, describes in his "Voyages," the expertness of some tribes of North-eastern Asia, in drawing figures of animals on walrus tusks and the teeth of the sperm-whale.

In an evident zeal to make these people a connecting link between man and the apes, have not some writers exaggerated, on rather slight data, the degraded and savage character of these primitive folk?

Have not geologists also exaggerated the geological age of the Stone period, carrying it too far back, and also not bringing it near enough to historic times? In the first flush of the interest excited by these startling developments, they also have demanded too great a cold for the climate of Middle Europe. Associated with these Mammoth bones and drawings were sketches of an animal like the Irish elk, which historical evidence tends to show existed up to the fourteenth century; of the reindeer, which Cæsar refers to in his Commentaries, which Boyd Dawkings thinks must have lived in Northern Scotland as late as the twelfth century, and which remained in Denmark up to the sixteenth century; of the bison, which still survives in Lithuania, the urus, aurochs, or *Bos primigenius*, which is said to have lingered in

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who were taught to speak by men of the Aryan race who shared the land with them, or, as the December number of Blackwood has it,—

"Anthropologists say, after man had his birth,
There were two human races possessing the earth;
One gifted and graced with articulate speech,
And another that only could gabble and screech.

The Aryans could speak, and could build, and could plough,
And knew most of the arts we are practising now;
But the Dumbies that dwelt in those vile Kitchen-middens,
Weren't fit but to do their superior's biddings.

So an Aryan went forth to enlighten these others,
And to raise them by speech to the level of brothers;
On the Mutes of the Middens he burst with eclat,
And attempted to teach them the syllable PA."

The rather infantile science of the Anthropological Review, put into easy verse, does not state whether Aryan implements and relics have been found in the Kjœkenmœddings. But thus far has any evidence of an intermixture of two races, one so much higher than the other, been found in Denmark during the Stone Age? We shall wait patiently for a few pertinent facts; meanwhile, in these days of equal rights, advocating Kjœkenmœdding suffrage; believing that they were born with all their senses and faculties such as they were, and stood on the same level with their Finnish and Lapland allies or representatives of later times.

Switzerland up to the sixteenth century, and the wild boar, still abundant in Central Europe.

The Mammoth, then, was hunted in middle Europe by a hardy race of men (the Reindeer Folk), savage, it is true, but who wielded the spear, and shot flint-headed arrows at the enormous beasts they hunted; and, resting from the fatigues of the hunt, engraved on ivory* the animals slain by them with a sort of hard-pointed style; whose wives probably made garments of skins sewed with delicate bone needles, and whose families seemed to have been well housed

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*"In the working of bones, especially the antlers of the reindeer, these Reindeer men seem to have excelled. Lance and arrow-heads with barbs, knives, and daggers, all kinds of flat and curved shapes apt for scraping the skins and similar objects, awls and needles of considerable fineness, with eyes fit for the passage of a thread; handles are found in quantity, and some unfinished specimens show the troublesome mode by which these implements were brought to a finished condition.

"The art products of the Reindeer people who inhabited France are of particular interest. The decorations on many pots and implements, consisting of simple, straight, angular, or crossed lines, exhibit a certain sense for beauty; but the drawings of animals, as discovered by MM. Lartet and Garrigou, are still more surprising. They are mostly found engraved on bones, but also on slate. Those found by M. Garrigou represent heads and tails of fishes; those in possession of M. Lartet represent large mammals, among which the reindeer is easily recognized by the antlers. Most of these drawings occupy, certainly, merely that rank in art as a schoolboy's attempts on the wall, in order, as a little nephew of mine observed, to derive pleasure from its contemplation. Many of these drawings only furnish us with the idea of horned ruminants in general, leaving to our choice to detect the difference between oxen, sheep, and goats; others, however, are sufficiently characteristic to enable us to recognize the animal at once, although the proportions are somewhat faulty. The masterpiece in Lartet's collection is a handle carved from the antlers of a reindeer, a real sculptured work, the body of the animal being so turned and twisted, that it forms a handle for a boy's hand. All other drawings are in sharp and firm outlines, graved upon the surface of the bone, and it may be seen that the artist, in working it, turned the bone in various directions, some of the lines showing a flat inside turned surface. Many of these drawings are known to the public by the treatises of Lartet and Christy on the caves of Perigord; but I can, from my own inspection, assert that there exist in that collection many others, and these highly characteristic. Thus I recently saw in my friend Desor's collection two plaster casts of pieces found in a heap of bones of the Reindeer period, at Madelaine, near Tursac (Dordogne). It is a kind of kitchen-midden at the foot of a rock, about fifteen mètres long, seven mètres broad, and two and a half mètres thick. In the middle some human remains were found. One of these pieces is a broken-off femur of a swan. The animal carved upon it has a short thick tail, a long straight back and belly, the head and the lower parts of the feet are wanting; a zig-zag line along the back, imitating somewhat rudely the aspect of the reindeer in summer, when the long winter-hair still hangs in flocks about the back, whilst the belly shows already the short dark summer hair. Some short lines before the forefeet may represent the hair of the throat. The second is a fragment either of a femur or a tibia. It represents two reindeers following each other (?), the one being known by its indication of antlers. Further explorations will, no doubt, increase our treasury of art products of the reindeer period."—(VOGT.)

in caves and rock-shelters and rude huts, at a period long before the first dawnings of history.

So far from being lower than Australians and Hottentots, they may have been the ancestors of the Calmucs and Fins and Lapps. Living near glaciers which descended into the plains of France down the slopes of the Alps and Pyrenees, which brought Alpine and ice-inhabiting animals close to their hunting-grounds, they yet chased the boar through the forests, the elk through the morasses and grassy intervals, and pursued the musk-ox, the roe, the chamois, ibex, Pyrenæan deer, and, most abundant of all, the reindeer, over the snow-fields lying on the hills and uplands; and in the lower plains and valleys watched by night, made hideous by the cries of the cave-hyena, for the Mammoth and mastodon, the cave-bear, the lion, tiger, and tichorhine rhinoceros, as they came from their retreats to slake their thirst at the river bank.

Professor Carl Vogt, in "The Primitive Period of the Human Species," translated for the Anthropological Review, has given the most recent and more moderate views regarding the Stone Folk. With Lartet and Christy he divides the Stone Age into two periods: first, the "*Cave-bear epoch*, distinguished by large, now extinct, species of beasts of prey and pachydermata, rude flint implements, coarsely worked bones, and long cranial forms of a strong race of men;* and second, the *Reindeer period*, characterized by the

*"In endeavoring, from the discoveries hitherto made, to form conclusions respecting the civilization of this long-headed (inferring from the Neander skull), powerful, tall, and strong primitive man, who lived by the side of the cave-bear and the mammoth, we perceive that already then he honoured his dead by burying them, probably in a crouching position, in grottoes closed with slabs; and that he furnished them with meat and arms for their journey into another world. He knew the use of fire, and constructed hearths, where he roasted his meat: for of pottery the traces are but few. He broke the long bones of the larger animals in a systematic manner, in order to extract the marrow; and also the skull, to obtain the brain. His implements or weapons consist of rude hatchets and knives, which were struck off from a flint block by another stone; and of worked bones, employed for handles, arrows, clubs, or awls. Such pieces as look like pike or arrow-heads never show any grapple-hooks, but smooth sides. This wild primitive man, the wildness of which is indicated by his terrible superciliary arches, nevertheless endeavored to ornament his person with perforated pieces

northern fauna of a cold climate, by hammered stone weapons, carved and artfully decorated bones, and the short skulls of a small and more delicately constructed, but, at all events, a very intelligent art-endowed race of men."

But is it not possible that the two races lived contemporaneously? The Reindeer Folk may have inhabited the upper valleys and hills near the Alps and Pyrenees, which send spurs into Southern and Central France. They were, perhaps, mountaineers, and the animals associated with them, and most characteristic of the period, were alpine and northern species. Like the Lapps and Fins, the men were dwarfed, and more delicate, and perhaps more active-minded and ingenious than the Flint Folk. So far from dwelling exclusively in caves, they may have lived in skin lodges in summer, and in wooden or snow huts in winter.

Their neighbors, the Flint Folk, or Lowlanders, a taller and stronger race, meantime inhabited the plains of Northern France and Belgium, England and Germany, and the fauna was made up of the Mammoth, mastodon, and rhinoceros, horse, cave-bear (which was much more abundant than with the Reindeer people), bison, aurochs, and deer, which inhabited the more genial and fertile plains.

Taking this view, the supposed great length of the Stone Age is much reduced; it explains how two such dissimilar races lived side by side, just as the Lapps and Fins lived twenty centuries since, not far from the Celts and Tartars, on the mountainous parts of Europe and the borders of Asia; and while the climate was colder on the highlands, on the plains of Middle Europe it was, probably, much as described by Tacitus and Cæsar.

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of coral and the teeth of wild animals. He probably dressed in skins or prepared bark of trees; for the awls and needles found may have been serviceable for patching together such materials, but not for weaved stuff. We possess no direct information respecting his food, besides that he procured from the chase. The great number of flint instruments found in the caves, since attention has been drawn to this subject, lead us to infer that this man had spread over the whole of Central Europe this side of the Alps; whether in a single or various types, will only be decided when we are in possession of a greater number of skulls."

In our own land the Mammoth was associated with the *Mastodon giganteus*. Herds of the Siberian Mammoth found their way across Behring's Straits into Alaska, as their remains occur in the greatest abundance at Eschscholtz Bay. The explorations of Mr. W. H. Dall show how common it must have been to the southward in the Yukon Valley. It seems to have extended southward in America as far as the parallel of 40°, as remains, found at several localities in Canada, have been referred to this species.

Professor Leidy has claimed, on partial evidence (a complete skull not having yet been found), the existence of a truly American species of elephant (*Elephas Americana*), representing in the new world the European and arctic Hairy Mammoth. This species replaced, in the warmer parts of our country, the Siberian elephant. Its remains, like those of the mastodon, are found at the bottom of swamps and in the upper strata of river sands. It should be borne in mind by the reader, that these deposits of river alluvium are the most recent of the deposits of the post-tertiary age. They should not be confounded, as they often are, with the true glacial or drift deposits, which were thrown down at an immensely earlier period, so far as known facts teach us. In the Northern States, at least, we had the following succession of events antedating the appearance of the American elephants,* including the mastodon, though this does not preclude their existence southwards, where the climate was hotter. The warm climate of the latest Tertiary (Pliocene), in which the temperature of New England and the Northern States may have been like that of the Gulf States at the present day, gave way to the arctic cold that brought with it the snows and glaciers of the true Glacial epoch, the period which separates the Tertiary from the Quarternary

* "The American elephant ranged from Georgia, Texas, and Mexico on the south, to Canada on the north, and to Oregon and California on the west. . . . . The species appears to have been most abundant to the south, in the Mississippi Valley, it preferring a warmer climate than *Elephas primigenius*."—(DANA.)

periods. For ages the Ice King held sway over this immense territory. The walrus, and perhaps the musk-ox, the white bear and arctic fox occupied the land that had perhaps shook beneath the tread of the Megatherium and Bootherium, the American lion and the mastodon and elephant; and the creeping willow and procumbent birch and lowly cranberry, the snow white *Arenaria greenlandica*, and other arctic plants succeeded the gaudy flowers and luxuriant forests of the latest Tertiary soil.

Centuries after, the continent slowly sinks, perhaps six hundred feet; the sea laves the foot of the White Mountains; the temperature is raised and the glaciers have retreated to the Alpine valleys. This is the period of the *Leda clays*, in which bones of the bison and walrus are found. But not until a later and still warmer period, that of the rearrangement of these sands and clays into lake shores and fertile river intervals, does the Mammoth (so far as fossil evidence goes) seem to have flourished abundantly.

The remains of the mastodon, found lately in Indiana and stored in the museum of the Chicago Academy of Science, occurred in a peat-swamp four feet beneath the surface, over a bed of marl containing fresh-water shells. This willow swamp had been flowed by the beaver, as its dam and evidences of its lakes were still remaining. Indeed, there are accounts, which however need confirmation, of mastodons' bones being found in the Western States, associated with arrow-heads and other Indian relics, as if the creature had been mired in some "lick," and killed by Indians. We shall eagerly look for fresh discoveries in this direction by our Western naturalists. The mastodon seems to have been more abundant in the Middle States than the Mammoth. The habits and geographical range of the two animals, however, seem to have been very much the same. The true home of the earth-shakers was the Sivalik Hills at the foot of the Himalayah Mountains, seven fossil species of elephants, and three of mastodons having been found there, besides the

living species of elephant. A species of mastodon inhabited the Pampas of Brazil, the bones having been found in the bone-caves near Rio, and the *Mastodon Humboldtii* lived in the Andes. The *Mastodon giganteus* lived on the spruce and fir trees. The food of the tropical existing species is well known to consist of the leaves and succulent branches of trees.

It must seem strange to many of our readers to have had introduced, as a characteristic feature in our landscapes of prehistoric times, herds of wild elephants much exceeding in size the tamed imported specimens that march servilely through our towns and villages. How would the children of to-day grin and wonder with patriotic glee should a squad of veritable *American* elephants stalk through the gaping throng! Such fortune fell only to the lot of the prehistoric urchin. What glorious times were those when the children of the Mound-builders perhaps trooped on gala days of antediluvian rejoicing, to see trained lions and learned horses exhibit in the circus of those days (if the Preadamites were circus-goers); saw the megatherium fed, the hunger of the megalonyx and mylodon appeased with small forests of saplings, and—crowning delight of all—rode on the backs of docile Mammoths and more than elephantine mastodons!*

*These animals may possibly have been in America contemporaries of the earliest races of men, as some of the species or allied forms are now proved to have been in Europe.

Professor J. Marcou states that human bones have been found either *in* the bone-beds of the Natchez quarternary deposits, or in strata lying *over* them. Regarding the question whether man was really contemporaneous with the Mammoth and the quarternary mammals, Professor Dana states that "in North America there are no known acts sufficiently well authenticated to be here repeated."

Professor Dana, in his Manual of Geology, cites, among the characteristic mammals of this period in North America, the great beaver (*Castoroides Ohioënsis*), the *Bison latifrons* Leidy, a species much larger than the existing buffalo, and a genus of ox (*Bootherium*) related to the musk-ox. A species of stag (*Cervus Americanus* Leidy), larger than the great Irish Elk, and the American Post-tertiary lion (*Felis atrox* Leidy), about as large as the fossil lion of Britain. Other gigantic mammals, such as the *Megalonyx* and *Megatherium* and *Mylodon*, inhabited the Mississippi Valley, as their bones are found associated in the famous Natchez bone-locality with remains of the horse, bear, elephant, and mastodon, now known to have been a resident of North and South America long before Columbus made his voyages.

REVIEWS.

THE POPULAR SCIENCE REVIEW. London (Quarterly).

The October number contains a very valuable and beautifully illustrated article on the Microscope in Geology by David Forbes, of which we make use on another page. — Dr. M. T. Masters attempts to answer the question, Why the Leaves fall? After discussing several reasons given, he thinks "on the whole, then, of all the assigned causes for the fall of the leaf, this last, dependent on an alteration, or rather on a new growth in the leaf itself, is the most important, and probably the only one of itself sufficient to produce the result." This new growth is thus described from Von Mohl's account. "Shortly before the fall of the leaf, there begins to be formed a very delicate layer of cells, the growth of which is from above downwards, so that, beginning from the axillary side of the leaf, and gradually extending downwards and outwards, nearly at right angles to the long diameter of the cells of the leaf stalk, at any rate at right angles to the plane of the leaf, it effects a gradual separation between the stem and the leaf, as effectually as a knife would do." These changes of tissues and consequent fall of the leaf are not wholly due to a change of seasons "from wet to dry, or from hot to cold, for it not unfrequently happens that if a tree be stripped of its leaves in summer, it forms during the autumn new ones, which remain on the tree during the greater part of the winter, or at any rate until long after the usual period."

Dr. E. R. Lankester gives a very useful article, well illustrated, on the Flat-worms or Planarians. The subjoined table* presents the latest views as to the classification of *Worms* taken from Peter's and Carus

*A TABULAR VIEW OF THE CLASSES AND ORDERS OF VERMES.

Sub-kingdom: Vermes.

Class I. *Annulata* (Ringed-worms).
- Orders: *Polychæta* (Marine).
- *Oligochæta* (Land and Fresh-water).
- *Discophora* (Leeches).

Class II. *Gephyrea* (connected through the Sea-cucumbers to Echinodermata).
- Orders: *Sipunculus*, etc.

Class III. *Rotifera* (connected to Arthropods and Turbellaria).
- Orders: *Cephalotricha* (Wheel-animals).
- *Gasterotricha* (Hairy-backed animals, Chætonotus).

Class IV. *Nematelminthes* (Round-worms).
- Orders: *Nematodes* (Thread-worms, Vinegar-eels, etc.)
- *Gordiacea* (Hair-worms).
- *Acanthocephali* (Echinorhynchus).

Class V. *Platyelminthes* (Flat-worms).
- Orders: *Turbellaria* (Planarians and Nemertians).
- *Trematodes* (Flukes, King's Yellow-worms).
- *Cestodes* (Tape-worms).

Handbook of Zoölogy (Leipzig, 1863). We might say, however, that the more conservative zoölogist would substitute *class* for sub-kingdom, and *order* for class, considering the worms as a class of the "type," "branch," or "sub-kingdom" ARTICULATA. Such tabular lists of different classes of the animal kingdom we design to give from time to time in the NATURALIST. The *Rotifera*, or Wheel-animalcules, placed by Dana and other authors among the Crustacea, seem to the author to belong more properly with the Worms, connecting the latter with the Crustacea. He also notices the growing opinion among zoölogists, that the majority of the *Infusoria* may be classed among Vermes, near the Turbellaria, or Flat-worms, of which the dark, flat, leach-like worms abounding in our pools and on the seashore are examples. Their wonderful powers of reparation of injuries has been studied by Dugés, who, by slicing them with scissors, produced individuals with double heads and tails, and other modifications of form. The curious modes of reproduction are thus noticed: —

The Turbellarians propagate either by eggs deposited and fertilized in the water, several eggs being often deposited in one mass of yolk (like what was observed by Dr. Carpenter in the Dog-whelk), or by the growth of young from internal buds or pseud-ova, like the larvæ of Cecidomyia, or by transverse fission. Both Nemertians and Planarians exhibit these three methods. The young either develop directly, becoming similar to their parents at once, or they exhibit a jointed ringed structure (like Annelids), sometimes, too, carrying bristles, as has been lately shown by Mr. Alexander Agassiz, both in Planarians and Nemertians, and then, as they grow older, lose their jointed appearance and setæ; or the egg hatching results in a larva (*Pilidium*) which is totally unlike the parent, and from the body-wall of which a small worm-like animal grows and separates, leaving the bulk of the *Pilidium* to perish. This last case is very similar to that observed by Johannes Mueller in certain star-fishes. As in the Echinoderms, so in the Turbellarians, there appears to be no *rule* as to the method of development; nearly allied forms may present the most diverse conditions, the one passing through a larval stage, and the other developing directly in the most capricious manner.

Dr. Richardson writes on the Physics of the Brain, and concludes from experiments in freezing certain parts of the brain in animals, and other like experiments, by which the functions of the different parts or ganglia are determined, "that impressions are physical realities, stamped as it were on brain matter, each distinct and perfect when the matter on which it is set is in condition for motion. Everything we remember is, I doubt not, thus imprinted on the brain, on infinite points of brain-substance, each independent, free, and capable of motion when the whole mass is charged with force. The brain, in fact, is a world within of the world without that it has received in the course of its waking life."

When we see what the micro-photographer can thus do in putting physical impressions on what seem infinitesimal points of matter, and when we know that there is no assignable limit to this art, it is no crude inference that in the vast surface of the gray matter of the brain, in those cerebral lobes of which I have spoken, myriads of points of matter are thus impressed, — points of matter floating in that eighty-four per cent. of water, of which the brain is made up.

One more fact relating to the physics of the brain, as taught by experiment, and I have done. We have seen that when the anterior cerebral ganglia are destroyed for a time, an animal moves impulsively forward, and that, when the cerebellum is destroyed, the animal moves impulsively backwards. This indicates the existence of a balance of power between these centres (or ganglia); a balance which is also detectable between other centres. It is therefore a fair inference, that every centre of power in the brain is, during healthy states,

physically balanced, and that what is called a well-balanced mind is really a properly balanced brain. By this reading we explain many phenomena of living action otherwise inexplicable.

Among the reviews, a kindly word of welcome is given the NATURALIST. — MM. Bert and Blondeau have been experimenting on the contractions of the Sensitive Plant: —

M. Blondeau experimented on plants with the induced galvanic current of a Ruhmkorff's coil. He submitted three plants to the influence of the electric current. The first was operated on for five minutes; the plant when left to itself seemed prostrated, but after a while (a quarter of an hour), the leaves opened, and it seemed to recover itself. The second was acted on for ten minutes. This specimen was prostrate for an hour, after which it slowly recovered. The third specimen was galvanized for twenty-five minutes, but it never recovered, and in twenty-four hours it had the appearance of a plant struck by lightning. A fourth plant was etherized, and then exposed to the current. Strange to say the latter had not any effect, the leaves remained straight and open; thus proving, says M. Blondeau, that the mode of contraction of the leaves of the sensitive plant is in some way allied to the muscular contraction of animals.

NATURAL HISTORY MISCELLANY.

BOTANY.

MONSTROUS FLOWERS OF HABENARIA FIMBRIATA. — Mr. W. W. Denslow, of New York, found last summer a spike of this orchid with all the flowers abnormal, spurless, and fringeless. A few of the flowers, examined by me, exhibit the following peculiarities. All of them are dimerous, even to the ovary. The most reduced has the perianth simply of two sepals, anterior and posterior, and the anther and stigma nearly normal: no vestige of petals. The others have a perianth of four pieces, resembling the normal sepals, no labellum, and generally two anthers, alternating with the inner pieces of the perianth. One of these anthers is occasionally somewhat petaloid, but with one or both the cells well formed, although more separated on the petaloid connective; the pollen and the gland nearly normal. In one flower the two opposed anthers are exactly similar, and nearly normal, but with the slender tip of the cells more curved, so that the glands which are contiguous in pairs, are upturned. The stigma is central and symmetrical. In more than one flower there is an attempt at a second pair of anthers, within and alternate with the others; one of these is occasionally well formed, and the other rudimentary. — A. GRAY.

THE ELDER (SAMBUCUS CANADENSIS) AS A NATIVE PLANT. — The responses to our inquiry are generally in favor of the affirmative. The most explicit testimony received, however, is the following, from our excellent correspondent, Mr. M. S. Bebb. He writes: "I never saw *Sambucus Canadensis* out of a fence corner; but my father who was born in Southern Ohio in 1802, and who remembers distinctly the first White and Red Clover, Blue Grass, and Black Mustard he ever saw, — he lived in the back woods nine miles from any settlement, when Cincinnati and Marietta

were mere hamlets, — declares that the Elder was abundant on the islands of the Dry Fork of the White-water River, in the earliest settlement of the country; that he remembers very distinctly making 'spiles' of its stems when tapping sugar-trees, and that it was a great pest in low bottom-lands, and had to be eradicated with much labor when clearings were made." — A. GRAY.

GERMAN IVY, SO-CALLED, FLOWERING UNDER PECULIAR CIRCUMSTANCES. — Mr. L. H. Brown, of Dayton, Ohio, informs us that branches of this delicate climber, cut in October, were carried into the house and hung around picture-frames upon the walls of a room in which, until winter set in, there was no fire. In about three weeks they began to put forth blossoms, which have never been seen upon the plants growing in soil, and they have kept on blooming for several weeks, the vine growing freely. The old leaves soon withered, but those of new shoots took their place. — A. GRAY.

LESPEDEZA STRIATA Hook. and Arn. The notice in the November number has called forth several communications from the South, where this plant is attracting much attention. Both Mr. Ravenel and Professor Porter call Dr. Gray's notice to the fact, that they sent specimens to him twenty years ago. The Rev. Dr. Curtis writes that the new comer, if we may call it so, has reached Charlotte, North Carolina, where it is a perfect God-send, taking complete possession of the worn-out fields, and is cropped by cattle with such avidity that a good specimen is hardly to be obtained. Professor Porter writes as follows: —

"I have read with great interest the note of Dr. Gray concerning the introduction of this foreigner into the Southern States, and, as the date when, and the place where it was first observed, may be of importance, wish to put on record the fact, that, twenty-one years ago, in August, 1846, I collected the specimens, now in my herbarium, in Monticello, Jasper County, Central Georgia. It grew in a wild nook by the side of a road, at some distance from the village and any human habitation. I never dreamed of China and Japan, and have hitherto regarded it as a native waiting for a name." — T. C. PORTER.

A RELIC OF THE GLACIAL EPOCH. — On the south bank of the River Delaware, in Bucks County, Pennsylvania, fifteen miles below Easton, and forty north of Philadelphia, there is a range of perpendicular, forest-crowned cliffs, extending east and west for a mile and a half, and varying in height from three to four hundred feet. The rock is New-red sandstone, identical with that of the valley of the Connecticut, as shown not only by its lithological characters, but also by the fossil footprints which it contains. On the faces of the cliffs are several extensive water-drips, and at two or three points they are penetrated by narrow and shallow ravines, down which rivulets come leaping. At these places the ice accumulates in immense masses during the winter, and lies undissolved until late in the spring. This was observed whilst passing along the railroad

on the opposite side of the river, and the inference drawn that the mean annual temperature of the rock would be so reduced by the slow melting of the ice, and the large amount of evaporation in summer, as to afford favorable conditions for the growth of northern plants. In hope of finding something of the kind, the spot was visited on the eighteenth of May, 1867, in company with Professors Green and Hitchcock, of Lafayette College, and our search was rewarded by the discovery of *Sedum Rhodiola* D. C., — an inhabitant of high latitudes in Europe and America, its nearest known station in our country being Quoddy Head, on the eastern border of Maine. The existence of such a plant in such a locality can well be explained only by the supposition, that, when the arctic flora retreated northward at the close of the glacial epoch, it was left behind. Far up on the ledges of the rock, chiefly under the drip of the water, it grows in dense tufts, whose pale, glaucous hue attracts the eye of the botanist, in situations so difficult of access, and in such abundance, that it bids fair to maintain its hold as successfully for ages to come, as it has for ages past.

It may not be amiss to state also that in New Jersey, ten miles to the north of these cliffs, *Polemonium cæruleum* L. has been recently detected in a large, shaded, sphagnous swamp, where it is evidently indigenous; and that, a few miles farther on, in the same range, occur other northern species, among which are *Bidens Beckii* Torr., *Lobelia Kalmii* L., *Betula pumila* L., and *Carex flava* L. — T. C. Porter.

Polyporus frondosus. — A specimen of this enormous fungus was recently exhibited at one of the Horticultural Society Exhibitions at Boston. It was found growing on the decayed stump of an oak tree in Boxford, Mass., by Mr. James Barratt. It belongs to a group of the *Polypori*, which is characterized by an eccentric growth. From a central base arise large imbricate clusters of rounded, lobular extensions which grow from the pseudo-branches of the main stipe. These lobes are light-brown above, and the texture of the upper portion is stringy and scurfy. Underneath they are studded with the numberless pores which give rise to the plant's generic name. The species of the genus are very numerous, all of them markedly characterized by the multiplicity of minute pores which clothe the under surface of the expanded top, called the *pileus*. Many of them have the upright stem, called the *stipe*, exactly in the centre, so that the plant resembles an umbrella, the sticks of which are replaced by a serried mass of vertical tubes, on the inner surface of which grows the reproductive dust called *spores*. The *P. frondosus* produces its *pilei* in side growths, which look like thick, fleshy leaves, and hence the specific name.

Many of these eccentric species grow to an enormous size. The specimen referred to was four feet in circumference. A specimen of *P. giganteus*, collected in Forest Hill Cemetery some years ago, was over five feet in circumference, and weighed ten pounds. — C. J. Sprague.

THE TORREY FESTIVAL.—The Botanical Club of New York has been for some time engaged on a catalogue of the plants growing within thirty miles of New York city. A catalogue, embracing the same territory, was made in 1817, by Dr. John Torrey, and the club celebrated the fiftieth anniversary of its completion by a supper at the Astor House, on the twentieth of December. Invitations were extended to those who had prominently identified themselves with American botany, and the club wishes us to say that they used all possible diligence to invite all interested, and if there were any omitted, it was from inadvertence. The day was unfortunately one of the most inclement of the year, and the impediments to travel prevented many from coming from abroad. Among the guests were Professor Gray and Dr. Pickering, of Cambridge; Professors Eaton and Brewer, of New Haven; Professors Porter and Green, of Easton, Pa.; Thomas P. James, of Philadelphia; S. T. Olney, of Providence; C. F. Austin, Closter, N. J.; S. B. Parsons, of Flushing; and I. Buchanan, of New York. All present were furnished with a button-hole sprig of Torreya, and after a short time spent in social intercourse, the company were seated at table, Professor Thurber presiding. After the substantials had been disposed of, Professor Thurber gave the following

ADDRESS.

For some occult reason I have been placed in a position where I am to speak for the Botanical Club of New York. It is indeed a pleasure to meet such a number of botanists, and my first duty is to express the thanks of the club to those who have come from abroad at this inclement season to aid us in our festivities. The incentive to this genial gathering is so well understood, that any elaborate remarks are fortunately unnecessary. On December 22d, 1817, there was presented to the Lyceum of Natural History, "A Catalogue of Plants growing spontaneously within thirty miles of the city of New York." The Botanical Club, which comprises, so far as we are aware, all the working botanists of New York and its suburbs, has thought proper to mark the fiftieth anniversary of an event so interesting to local botanists, and the commencement of a career so important to botanical science, not only in America, but in the world.

Here I must correct an error of the printed invitations, which are made to say that this is the fiftieth anniversary of the publication of the catalogue. The title-page bears the date of 1819, and an explanatory advertisement says, "Although the following pages were reported as early as December 22d, 1817, unavoidable obstacles have delayed its publication until the present time." It is not the publication of the catalogue that we celebrate, but its completion and presentation to the body which requested it to be prepared. As the 22d day falls this year on the sabbath, the nearest convenient day was chosen. There may be those who think it would have been more appropriate to regard the anniversary of publication, rather than that of its presentation. Such are assured that the club will consider the subject in season for the centennial anniversary. This little volume is now so rare, that I have brought it here, in part be-

cause it may be of interest to some to see it, but mainly because its time-stained pages would prove more eloquent than any words of the speaker. It is the author of this little catalogue in whose honor we are assembled. I am aware that on occasions like the present it is customary for the speaker to assume that the hearers are quite in doubt as to the person spoken of, and to relieve their minds only at the close of his speech, by announcing the name of the one who has been eulogized. Unskilled in the arts of the table orator, and quite sure of being unable to keep this company in a state of suspense, I go directly to the point and say that the author of the catalogue is Doctor JOHN TORREY.

As we look through the pages of the volume, we are astonished at its completeness, and wonder that a mere youth could have accomplished the great amount of preparatory labor necessary to the task.

In imagination we can look back over the intervening half century, and see the young enthusiast herborizing in localities that are to be found only in this catalogue. The "swamp behind the Botanic Garden," and the "bog-meadows near Greenwich" have long ago been built over, and Love-lane is now a paved street. The station here recorded for *Draba Caroliniana* has ceased to be available to the botanist of the present day, as that plant no longer grows, according to the catalogue, "in sandy fields about Canal street." Not only have localities disappeared, but those whose names are associated with them, and who are recorded as having contributed material to the catalogue, have passed away also. Mitchell, Nuttall, Rafinesque, Eddy, LeConte, Cooper, and others, while they live in the memory of a few of those present, are to the most of us known only by their works. From this catalogue as an initial point, let us briefly survey the intervening half century with reference to the botanical works of its author.

In 1820, there appeared in Silliman's Journal, vol. 4, *A Notice of Plants collected by Capt. N. Douglass around the Great Lakes at the Head-waters of the Mississippi.*

In 1823, the Annals of the New York Lyceum of Natural History contained the first instalment of the many precious contributions made by the author to our knowledge of the plants of the far West. Its title is, *Descriptions of some new or rare Plants from the Rocky Mountains, collected by Dr. Edwin James.*

In 1824 was published, *A Flora of the Northern and Middle United States, or a Systematic Arrangement and Description of all the Plants heretofore discovered in the United States north of Virginia.* But one volume of this work was published, and as a portion of the edition was destroyed by fire, it is now only rarely to be met with. It contains over five hundred pages, and includes the first twelve classes of the Linnæan system.

In the same year, 1824, we find in the Annals of the Lyceum, *Descriptions of new Grasses from the Rocky Mountains;* and in the same volume Dr. Torrey appears as editor and joint author with Schweinitz, of *A Monograph of the North American Species of Carex.*

The year 1826 was marked by the publication of the *Compendium of the Flora of the Northern and Middle States*, a work so full, concise, and compact, that it was indeed a compendium. Probably some of those present can remember when this volume came to their relief, and the delight with which they turned to its brief diagnoses, after puzzling over the vague and unsatisfactory descriptions of other works.

On the 11th of December, 1826, our author read before the Lyceum, *Some Account of a Collection of Plants made during a Journey to and from the Rocky Mountains, in the Summer of* 1820, *by Edwin P. James, M. D., Assistant Surgeon U. S. Army.* This paper was not published until 1828. It is a memoir of some eighty pages, and enumerates 481 plants, many of which were new species. This was, up to the date of its publication, the author's most important contribution to science, and is even now frequently referred to by the student of our Western plants. It besides has an especial interest, as it was the first American work of any importance in which the arrangement was according to the Natural System. The only exception to this is a list by Abbé Correa, of those genera appended to Muhlenburgh's Catalogue, arranged according to the Natural Orders of Jussieu. *A Catalogue of North American Genera of Plants, arranged according to the Orders of Lindley's Introduction to Botany*, was published in 1831, both in a separate form, and as an appendix to an American edition of Lindley's work.

In 1836, the Annals of the Lyceum are rich with the *Monograph of the Cyperaceæ*, and the volume for 1837 contained a memoir on *New Genera and Species of Plants.*

The year 1838 saw the commencement of the *Flora of North America, by John Torrey and Asa Gray*, which was published in numbers and at intervals until the year 1843. The rich treasures brought in by our Western explorers interrupted the continuance of this work, and its authors directed their energies to plants from hitherto untrodden fields. That elaborate work, in two large volumes, *The Flora of the State of New York, by John Torrey*, was published in 1843, a year which began a remarkable era in American botany. In that year commenced that magnificent series of contributions to our Western Flora by Torrey, Gray, and others, which followed one another in rapid succession. Nicollet's plants, published in his report in 1843, was the first of this almost continuous series of reports, of which I will mention only those wholly or in part by Dr. Torrey. That daring young lieutenant of the Topographical Engineers, now General Fremont, made two expeditions to the Rocky Mountains, the botanical results of which appeared in 1845. The report of the plants collected by Emory followed in 1848.

In the Smithsonian Contributions we find three memoirs by our author accepted in 1850, though they were not published until a year or two later. These were *A Memoir on Batis*, another on *Darlingtonia*, and *Plantæ Fremontianæ*, which last contains descriptions of some new plants collected by General Fremont in his memorable expedition to California.

The year 1852 gave us the plants collected by *Stansbury in the Region of Salt Lake*. The plants of *Marcy's Red River Expedition* appeared in 1853, and those from *Sitgreaves' Zuni and Colorado Journey in* 1854.

The rich collections made by the botanists attached to the several Pacific Railroad Surveys, were published in 1855 and 1856. The plants of some of these expeditions were elaborated by Newberry, Durand, and others. Those collected by Beckwith and Gunnison, and by Pope on the Llano Estacado, appeared under the joint authorship of Torrey and Gray. The botanical portions of the reports of Parke, Williamson, and Whipple are by Dr. Torrey. The report of Whipple's Expedition is the most extensive of all these Pacific Railroad contributions to botany, as the journey crossed a country not heretofore penetrated by any botanist, and which afforded a rich harvest not only in new species, but new genera. To the other reports, those which do not bear his name as author, of the botanical portion of them he contributed freely, often working up entire families.

The most voluminous, as well as in some respects the most important of these Botanical Reports of the Government expeditions is that of the Mexican Boundary, published in 1859, and with this I close this chronological account, remarking that some contributions to science have been omitted altogether.

This little catalogue of 1817 began the list, and it closes with the elegant quarto of the Mexican Boundary. Indeed there is no student of American Botany who has not almost daily occasion to refer to the works of TORREY.

Is it not fitting, then, that we should celebrate the fiftieth anniversary of the opening of a career that has brought so many benefits to us, and has given such lustre to American science? I have spoken of what would seem to be the work of a lifetime; but when we recollect that all this was done aside from other duties, as recreation from labor as it were, we can only wonder at the zeal and industry it indicates. But those who estimate the services of Dr. Torrey to botany from his published works alone, omit a large and important share. Those present do not need to be reminded of the personal aid he has given them in their studies. What lover of plants, however young or unskilled, ever failed to receive his patient attention and kind word of encouragement? Not only those who have had the advantage of personal acquaintance with him, have been the recipients of this aid, but those who have never met him have felt it through his correspondence. These are works that will never be published, but they are deeply imprinted on the hearts of botanists in all parts of the country.

It may be thought that this hurried review of the botanical labors of our guest is incomplete, without some reference to his character as a man.

It is always a delicate task to speak fittingly of another in his presence; and I could hardly trust myself to give utterance to what I feel is due him. Happily I am saved from the embarrassment that the attempt

would bring, by speaking what is in the thoughts of all here present. Every one who has been brought in frequent communication with him knows that he has forgotten the philosopher in the friend, and that he has been made not only a better botanist, but a better man.

Many years ago, Arnott published in Taylor's Annals of Natural History a description of a new genus, established on one of the beautiful Conifers of Florida, and gave it the name of *Torreya*. The Florida species is *Torreya taxifolia*. Since then there have been added to the genus *Torreya nucifera* from the island of Japan, *Torreya Californica* from the Pacific coast, and possibly another from Northern China, *T. grandis*. While we are glad that a so fine and widely spread genus should bear the name of our friend, we regret that Arnott had not been more happy in his choice of a term to designate our native species. Although a native of Florida, it is hardy on this island, and even as far north as Fishkill, on the Hudson. It holds its bright foliage through the cold and snows of winter, and its presence here suggests thoughts of more genial climes and seasons. Had Arnott possessed the power of prophecy, he surely would have written *Torreya sempervirens;* for does not he whose name it bears disregard the frosts of time? Does not his presence always bring genial summer, and show us that years bring no winter to the heart which has not lost the freshness of youth, but in which love — love to man and to God — reigns supreme? Long after the flowers shall have bloomed above us all, future botanists will carry on the work he has so nobly helped. Those yet unborn will wander by the Southern rivers, visit the mountains of far-off Japan, or climb our own grand Sierra Nevada in search of the Torreya, and his name will be remembered as long as there shall be botany and botanists. But these can only talk of him whom it is our privilege to know, to honor, and to love, and whose presence we now greet with the already too long-delayed sentiment: Long life, health, happiness, and every blessing to our honored guest, Doctor JOHN TORREY.

Doctor Torrey, after feelingly expressing his thanks, and the surprise which this demonstration was to him, gave an interesting account of his first introduction to the study of botany, and the great difficulties that attended the student in those days. Botanical books, which, or their equivalents, are now to be had by every one, were then only to be found in the library of the New York Hospital. Doctor Torrey gave an account of some of the earlier teachers in the science, — Hosack, Eddy, Mitchell, and others, and a sketch of the history of the Elgin Botanic Garden.

The next regular sentiment was, "The Flora of North America; its past history and future prospects." This was responded to by Professor Gray, who facetiously remarked that he hardly knew what Flora was intended; but taking one view of it, if he were to judge from the number of young devotees that he saw, he should consider Flora's prospects very flattering. He spoke of those who were collaborators in the Flora of North

America, and especially of Sartwell and Dewey, both of whom had recently died, and to whose memory he paid a feeling tribute.

Dr. Pickering, who was with the U. S. Exploring Expedition, replied to a sentiment referring to government aid to science. Professor Eaton, to one on botany in our colleges. The Flora of California was the subject of remarks by Professor Brewer, which were interesting as well as humorous. Mr. Wm. Leggett, of the club, gave an account of the new local flora now in preparation. Mr. James Hogg, a member of the club, spoke of the relations of botany to floriculture. Professor Porter, Mr. S. T. Olney, and Professor Trail Green each made brief speeches.

One of the interesting events of the evening was the production by Mr. T. P. James of a manuscript volume found in the Library of the Academy of Natural Sciences of Philadelphia. Although the writer's name is not given in the volume, yet from the places visited and the plants mentioned, there is no doubt that it is the diary kept by Pursh while he was in this country. It is very minute in its account, and is written in such imperfect English, that readings from it created much merriment. It came into the possession of the Academy with the plants belonging to the late Dr. B. S. Barton, who, it is well known, was a friend and patron of Pursh. Professor Gray remarked upon the singular way in which things long separated would sometimes come together. He had, from the sale of Lambert's library in London, a MS. map of the United States, with Pursh's route traced upon it, and as that evidently belonged with the diary, he should take pleasure in presenting it to the Academy.

Letters were received from many botanists who were unable to be present; all of them expressed great regret at their necessary absence, and each one conveyed the warmest good wishes to Doctor Torrey.

The letters were read by Dr. F. J. Bumstead, and among them were those from Professor J. T. Rothrock, Dr. J. W. Robbins, L. Lesquereaux, George Vasey, George W. Clinton, Dr. J. Carson, Professor E. Tuckerman, W. D. Brackenridge, Professor J. Lewis Russell, Dr. Z. Pitcher, Professor J. P. Kirtland, and that of Dr. Jacob Bigelow, now the oldest American botanist, we give entire.

BOSTON, Dec. 12, 1867.

GENTLEMEN, — Your kind and flattering invitation, requesting my presence at a supper to be given in New York in honor of my much respected and long-esteemed friend, Dr. John Torrey, is received with much gratitude. If it were now May or June instead of bleak December, I should be irresistibly tempted to join in your appropriate festivity. But as there is at present no travelling conservatory between Boston and New York which can be relied on effectually to exclude the frost, I am obliged reluctantly to give up the proffered pleasure. My acquaintance with your honored guest, Dr. Torrey, dates back for half a century. At that distance of time, I had devoted myself considerably to Botanical studies, and had published a little work on the plants of Boston. Dr. Torrey, who was then meditating a national work on North American plants, with more kindness than discretion, wrote me a letter, generously offering me the use of his collections, notes, and personal assistance, if I would undertake the enterprise. Fortunately for Botanical Science, I declined the responsibility, and the work has since been wholly carried out by himself and his distinguished colleague, Professor Asa Gray. For myself, I have been obliged to confine my herborizations mostly to the pavements of the streets, though at times I have broken loose in pursuit of my first love, and have gathered plants on the Rhine, the Rhone, the Tiber, and the Danube, not overlooking the St. Lawrence and the Mis-

souri. In June of last summer I found myself culling simples at Fort Harker, away among the buffaloes and prairie dogs on the Smoky-hill fork of the Kansas River.

Although if a scientific section of my trunk were now to be made, it might exhibit about four-score annual circles, yet I am happy to state that the ligneous fibres appear thus far to do their duty, and the sap vessels to transmit their contents. And I confidently trust that on no occasion will my botanical friends find me to be hollow-hearted.

I am, gentlemen, with the greatest respect, your obedient servant,

JACOB BIGELOW.

ZOÖLOGY.

THE BREEDING HABITS OF BIRDS.—I notice in the November number of the NATURALIST an article from Mr. Fowler, in which are given some interesting facts in relation to the breeding habits of several of our birds, but which are, as Mr. Fowler says, so utterly at variance with the accounts given of these bird's habits in my recent book, that I unwillingly trespass on your limits for an explanation, and reiteration of some of my remarks. In the work referred to, I describe the Kingfisher's nests as being placed in holes excavated in sand-banks, to the depth of three, four, sometimes six or eight feet.

The holes found by Mr. Fowler were less than three feet in length, and none of them contained any nest materials whatever. Here Mr. Fowler's experience is entirely different from my own, for of numbers of these holes that I have dug out, many of them were beyond four feet in length, one certainly more than six feet, and I have heard of one that was carried to the depth of nearly eight feet. All of these holes had their loose nests composed of straws, sticks, and a few feathers, and I should be surprised to meet with the eggs laid on the cold damp earth, such as would be at the bottom of such deep excavations. I find, on referring to the various authors, that nearly all had similar experiences with mine.

Audubon says, "The hole is dug to the depth of four, five, or sometimes six feet; at the farther end, on a few sticks and feathers, the eggs are deposited."

Wilson says, "The hole is dug, sometimes to the extent of four or five feet. The nest is constructed of loose grass and a few feathers."

Nuttall says, "The bank is horizontally perforated, to the depth of five or six feet. Here, on a few twigs, grass, and feathers, the eggs are deposited."

Dr. Thompson, in "Birds of Vermont," says, "The perforations sometimes extend five or six feet into the bank. The nest consists of twigs, grass, and feathers."

In describing the breeding place of the Red or Mottled Owl, in my work, I use the following language: "The Mottled Owl selects for a nesting-place a hollow tree, often in the orchard. The nest is made at the bottom of the hollow, and is constructed of grass, leaves, moss, and sometimes a few feathers. It is not elaborately made, being nothing more than a heap of soft materials."

Here again Mr. Fowler disagrees with me, saying that the bird makes no nest, or, at least, he has never found one. I can only say that I have found numbers of the nests of these birds, none of which were in the "abandoned nest of the crow or hawk," but all were made, as before described, in holes in trees. I have had over fifty eggs of this species sent me during the past season, and all were found in such nests as I have described. With this species I also find that my accounts are supported by other authors.

Nuttall says, "The nest is usually in the hollow of an old orchard tree; it is lined carelessly with a little hay, leaves, and feathers."

Audubon says, "The nest is placed in the bottom of the hollow trunk of a tree, often not at a greater height than six or seven feet from the ground, at other times so high as from thirty to forty feet. It is composed of a few grasses and feathers."

Dr. Thompson, in "Birds of Vermont," says, "Their nest, which is made of grass and feathers, is placed at the bottom of a hollow tree or stub."

I give this matter this extended notice, not for the purpose of throwing discredit on Mr. Fowler's statements, for I know him to be a good observer, but to show that my descriptions will faithfully apply to, at least, the majority of occurrences in the breeding habits of the species referred to.

As to the matter of the Marsh Hawk's nest being "rather neatly woven," to which Mr. Fowler takes exceptions, I will say that perhaps "interlaced" would be a better word, since "woven" gives an idea of sewing, such as the process of preparing the nest of the Vireo and Oriole, but "interlaced" conveys the idea of careful adjustment, which should be understood in connection with the nest of this species. — EDWARD A. SAMUELS, *Boston*.

BEE PARASITE. — Inclosed you will find some thin shavings from boards and slabs where the *Xylocopa* abounds, with small eggs attached, which I strongly suspect to be those of *Anthrax sinuosa*. They are found quite numerously around the openings of the cells of the former insect, and also extend to some distance from them. In pressing some of these eggs with the point of a pin, small maggots made their appearance, but my lens was not powerful enough to enable me to make out what they were, but they seemed to me to resemble very much the Anthrax in its earliest stages, as I have found it on the Xylocopa. I have no doubt you can determine this matter,* and should it prove to be what I have supposed it is, it will open an interesting field for future observation. One reason that strongly inclines me to the belief that they are the eggs of Anthrax is, that one day I discovered an *Anthrax* on the wing by one of the openings of a Xylocopa cell, acting in the same manner as the Bot-fly in depositing its eggs on the horse. I was very busy at the time, and

*The eggs had dried up so they were not recognizable. — EDS.

did not look for the eggs until some time afterwards, when I found those of which the inclosed are a sample. However, I think if you find them to belong to a dipterous insect, there can be no doubt but they are those of *A. sinuosa*. — JAMES ANGUS.

HIBERNATION OF WILD BEES. — I beg leave to say that I think you have made a mistake in supposing or stating that the females only, and not the males of *Ceratina dupla*, survive the winter. Both sexes, according to my observations, hybernate, as also *Xylocopa Virginica*.

I beg leave also to make another correction. You say,* with regard to Ants, that the workers only hybernate. I have found the females of some species hybernating in common with the workers in great quantities, and not unfrequently males also. While this is the case with some species, I think what you say is correct with regard to others. — JAMES ANGUS.

JUVENILE NATURAL HISTORY SOCIETY. — We have in this city perhaps quite a scientific curiosity, namely, a *Juvenile* Society of Natural History, composed of boys less than twenty years of age. We have been organized two years, and are now in a very flourishing condition, although it was hard "tugging" for a few of us the first year. We have, for us, a large collection, and a good one, numbering some eight hundred specimens. We cannot, of course, do much at research, but we are coming surely along the road you older naturalists have gone; and, by and by, when we get on the frontier where you are, you will hear from us. — G. W. SMITH, *Grand Rapids, Michigan*.

PROTECTION OF TREES FROM INSECTS. — The quantity of fruit destroyed by insects that deposit their eggs in the blossoms is enormous. These creatures are said to have a great antipathy to vinegar, the mere odor of which is enough to drive them away, and, in some cases, to destroy them, and nothing more is required than to sprinkle the branches with a mixture of vinegar and water at the moment the blossoms begin to appear. The solution, consisting of one part of strong vinegar to nine parts of water, can be sprinkled over the flower-buds by means of a garden engine or syringe, or even with a watering-pot with a fine nose. — *Proceedings of the Entomological Society, London*, 1866.

OCCURRENCE OF THE BARNACLE GOOSE IN NORTH AMERICA. — A specimen of this goose (*Bernicla leucopsis*) has recently been received by the Smithsonian Institution from Mr. B. R. Ross, a gentleman well known for his collections and publications relative to arctic zoölogy. It was obtained by that gentleman near Rupert House, on James Bay (the southern end of Hudson Bay), and is believed to be the first North American specimen brought to the notice of naturalists. It has for a long time been indicated as belonging to our fauna, but only on hearsay evidence of gunners and travellers, and it is not mentioned by Richardson at all in his work on American Arctic Zoölogy. — S. F. BAIRD.

* Naturalist, Vol. I, p. 392.

A DOUBLE EGG.—Yesterday one of my servants, on opening a hen's egg found another egg within it. The inclosed was about the size of a robin's egg, with a well-formed, slightly rough shell. It lay in the white. The parent egg was fully formed and was eaten. I heard of it on arriving home, and secured the small one. It has not yet been opened.—E. L. S.

There are two similar specimens in the Museum of the Essex Institute. Two cases are also mentioned as occurring in England, in *Hardwicke's Science Gossip*, in which it states that a "communication was made last year to the Académie des Sciences of France, of a similar occurrence."—EDITORS.

HABITS OF THE STRIPED SNAKE.—A case of the common striped snake killing its prey—a common mouse—after a chase by crushing it in its folds in the boa constrictor manner, has for the first time come to my knowledge. In trying to escape, the mouse ran up the inner angle of a wall some eighteen inches, when the snake (which was about twenty-four inches in length) caught it, enveloping it in its folds with lightning-like rapidity, crushed and killed it, and then swallowed it, all after the manner described of the large constrictors, except perhaps the chasing.—F. W., *Newark, N. J.*

MICROSCOPY.

THE MICROSCOPE IN GEOLOGY.—D. Forbes, in the Popular Science Review, writes on this rather novel subject. After a few prefatory remarks upon the general advantages of the use of the Microscope in studying the intimate structure of rocks, the author divides them all into two classes, "Primary or Eruptive," and "Secondary or Sedimentary Rocks." Under the first head he states that "the mineral constituents of such rocks are seen to be developed as more or less perfect crystals, at all angles to one another," which he infers could only take place in a rock at one time, "in a state of liquidity or solution" (aqueous or igneous). When "quartz, leucite, calcite, felspar," and other colorless minerals present similar appearances in thin sections, they may be distinguished by "their optical properties and the use of polarized light;" by similar tests different forms of the same mineral may be separated, and the structure, whether crystalline or vitreous, determined, and the alterations in eruptive rocks produced by the action of water, the atmosphere, or other agencies advantageously studied. In conclusion, reference is made to the discovery by Sorby of the existence "of numerous minute fluid cavities in the quartz of granites," and also in volcanic rocks, "in the felspar and nephiline ejected from the crater of Vesuvius." These facts, and the farther statement that "fluid vapor, gas, and stone cavities, are common both to the volcanic quartz-trachytes and the oldest granites," are used as proving the great value of the microscope in this branch of inquiry. Under the head of Sedimentary Rocks, the author distinguishes

three kinds or classes: 1st. "Those composed of the immediate products of the breaking up of eruptive rocks." 2d. "Rocks built up of the more or less rounded or angular debris of previously existing sedimentary or eruptive rocks." 3d. "Rocks composed of mineral substance extracted from aqueous solution by crystallization, precipitation, or the action of organic life." Strata of the first class are often identical in aspect and chemical composition, but their irregular sedimentary structure is dissolved upon submitting them to the microscopical test. Very fine, compact rocks may be distinguished from crystalline rocks by the same means. "Roofing-slate, however, has a definite arrangement of the particles in lines, which constitute the lines of weakness or the cleavage of the slate." This arrangement, however, is explained by the effects of pressure, applied at right-angles to the structure itself, causing an elongation of some, together with a sliding movement of others of the particles.

Under the third head we notice that the clays of Staffordshire, when altered by contact with basaltic dykes, present a structure identical with common stoneware made from the same clays, and show "no change in mineral or chemical composition, beyond the expulsion of the water always contained in such beds." The foliated schists, quartzites, etc., show the contours of the original sand-grains, and, as Sorby has pointed out, the existence of ripple-drift and wave-structure.

ANSWERS TO CORRESPONDENTS.

THE MISTLETOE.—I believe it is the common opinion of naturalists that the common Mistletoe of this Southern country steals the *elaborated sap* from the stalk which supports it. I think it can be proved that it *does not*, but that it draws its portion of *crude* sap and elaborates it, returning a portion to the tree on which it grows. I would be very glad to know if I am correct in reference to the *common opinion* of *naturalists*, and will oblige you to inform me.—J. M.

It is not the common opinion that the Mistletoe of the Southern States, or, in fact, any parasite with green foliage, draws *merely* elaborated sap from its host; otherwise why the green leaves? We know that the office of green leaves is to elaborate sap, and therefore in those plants (*Orobanchaceæ*, *Monotropa*, etc.) which depend wholly upon their hosts for elaborated nourishment, we find no green leaves. We should be glad of the record of any observations, which have been carefully made, with the view of proving experimentally that the Mistletoe does not take elaborated sap alone (for it very probably takes *some*) from its host, as they could not fail to be interesting.—H. M.

THE MASTODON IN KANSAS.—I send you a photograph and description of a vertebra of some species of the *Mammalia* for determination. The whole skeleton is said to be imbedded in the mud in one of our

streams, where there is some danger of *savants* losing their scalps. One rib has been detached and ground up into powder by the Indians for medicine. — JOHN D. PARKER, *Topeka, Kansas.*

We referred your letter and photograph to Professor J. Wyman, who writes: —

"The photograph is unluckily taken from an *oblique* point of view, which I believe people will never learn to be a bad one. If the view had been *full* front, or full side, or full anything, it would have been better than this. I have come to the conclusion that it is either the last lumbar, or first sacral vertebra of a Mastodon. The great compression of the spinal canal is in favor of its being sacral."

ARE BEES INJURIOUS TO FRUIT. — In answer to the question by J. J. Gould (Wenham, Mass.), whether bees are in any way injurious to fruit, or lessen its quality or quantity, I would reply that all the evidence given by botanists and zoölogists who have specially studied this subject shows that bees improve the quality and tend to increase the quantity of fruit. They aid in the fertilization of flowers, thus preventing the occurrence of sterile flowers, and by more thoroughly fertilizing flowers already perfect, render the production of sound and well-developed fruit more sure. Many botanists think if it were not for bees and other insects, *many plants would not fruit at all.* This whole subject of the great office bees and other insects perform in the fertilization of plants has been fully discussed in the May, July, and October numbers of the AMERICAN NATURALIST, and by Professor Asa Gray in the AMERICAN AGRICULTURIST, beginning in May, 1866.

It is alleged that bees do injury in some way by extracting the honey from flowers. What is the use in nature of honey? The best observers will tell you it is secreted by the plant for the very purpose of attracting bees to the flower, otherwise it is of no use to the flower or fruit.

If all the bees were to be destroyed, I for one, if a farmer, would prefer to go into some other business. This prejudice against bees seems to us to have no foundation. Known facts prove the contrary. Farmers know too well the injury noxious insects do; it is more difficult to estimate the good done by hosts of beneficial insects. I believe that every intelligent bee-keeper and naturalist will assent to the truth of the above remarks. — A. S. P.

R. H., Nichols, N. Y. — The hymenopterous insect from the sugar-maple tree is the *Tremex columba.* It bores, while in the larva state, into the trunk of the maple and oak. The beetles are *Copris anaglypticus* Say, *Cicindela sexguttata, Ancylocheira 6-plagiata* and *A. fasciata.* The fly is allied to *Tabanus,* the House-fly, and has a powerful bite.

E. B., Wheeling, West Virginia. — The microscopic form found in Peruvian Guano appears to be one of the Polycystinæ. The only authority that we know of is Ehrenberg's Microgeologie. Specific, and even generic names, are almost useless in this group of Rhizopods. — C. S.

W. W. G., Ann Arbor, Wis. — The little insects called snow-fleas are probably the *Podura nivicola* of Dr. Fitch. They are found in winter at the foot of trees, under the bark of which they live, and also about manure heaps and in cellars.

The *Heleochara communis*, a homopterous insect, allied in form to the Cicada, or seventeen-year locust, produces the frog-spittle seen in midsummer on grass. The larva sucks in the sap, which passes through the body and forms a frothy mass concealing the insect.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Essex Institute, *Salem.* — *First Field Meeting at Haverhill*, on Tuesday, July 2, 1867, postponed from the preceding Thursday, on account of the weather. Haverhill, located on the north bank of the Merrimac, is a thriving and busy place, noted for its extensive manufacture of shoes. It abounds in interesting historic lore; for a period of seventy years was one of the most exposed of the frontier towns, and many harrowing tales of Indian barbarity is among its well-authenticated legends. The principal point of attraction to the naturalist is "Kenoza Lake," formerly known as the "Great Pond," a lovely sheet of water, embosomed among the hills, covering an area of about three hundred acres. During their rambles in its vicinity the party was rewarded in finding many interesting specimens in the various departments.

The afternoon session was held in the North Congregational Church, and was called to order at 2.30 o'clock, *Vice-president Fowler* in the chair. *Dr. George B. Loring*, of Salem, made a few eloquent remarks on the prospects of the year, and the occasion which had brought them together. *F. W. Putnam*, of Salem, gave a description of the habits of the common Plant-louse. *Dr. James R. Nichols*, of Haverhill, remarked that chemical science had recently discovered an effectual destroyer of plant insects, a new substance called Carbolic acid, which is eliminated from coal tar, and made farther comments on this subject. Dr. N. also spoke of the collections and library of the Institute, and alluded in very appropriate terms to the recent donation of Mr. George Peabody, for the promotion of science and useful knowledge in this county. *Edward S. Morse*, of Salem, drew a comparison of the studies of the naturalist near the sea with those made in the interior, and alluded to the families of animals found in these respective localities which are worthy of study. *Alpheus Hyatt*, of Salem, spoke of the geological features of this section of the county. *Rev. Dr. Seeley*, of Haverhill; *Hon. Allen W. Dodge*, of Hamilton; *Professor A. Crosby*, of Salem; *Dr. J. Spofford*, of Groveland; *Hon. Warren Ordway*, of Bradford, and others, made interesting remarks.

Second Meeting at Andover. — After a cordial reception by *Professor Thayer*, of the Theological Seminary, the company divided into small parties, and visited the various objects of interest; many went to the library and museum of the Theological Seminary, the new building of the Phillips Academy, etc. The naturalists repaired to the woods and meadows, and were amply repaid for their excursions. The meeting was held in the South Congregational Church. *Dr. George B. Loring*, of Salem, of the Field Meeting Committee, presided, and, on taking the chair, alluded to several interesting episodes in the history of this town, and briefly stated the objects of the Institute. *A. Hyatt*, of Salem, spoke of water as equalling fire in its destructive power,— its agency in producing the various changes on the earth's surface during the several geological epochs. *E. S. Morse*, of Salem, gave a description of several snails, which he had found during the previous ramble, and illustrated his subject by drawings on the blackboard. *Professor Hitchcock* exhibited a map of Andover, upon which he had designated, by different colors, the localities of the four principal kinds of rocks — granite, stratified gneiss, mica schist, and rocks resembling Quincy sienite. *George D. Phippen*, of Salem, spoke of the flora. *Rev. Mr. Smith*, pastor of the church; *Rev. C. R. Palmer*, of Salem; *Mr. F. G. Sanborn*, of Andover; *Professor D. Crosby*, of Dartmouth College; *Professor A. Crosby*, of Salem; *President Larrabee*, formerly of Middlebury College, and others, addressed the meeting.

Third Meeting at Beverly Farms, on Thursday, August 1, 1867. — Disembarking at Pride's Crossing on the Gloucester Branch Railroad, the party separated into groups, under guides familiar with the adjacent country. One of these groups rambled over the wild and elevated region known as "Beverly Commons," and noticed several large and peculiar boulders, also a large variety of interesting plants; another group visited the sea-shore, and strolled through the grounds surrounding the elegant mansions in that beautiful locality. A party of naturalists passed the forenoon in dredging the harbor for crabs, worms, mollusks, and zoöphytes.

The afternoon session was held in the Second Baptist Church, at 2 o'clock, *Vice-president A. C. Goodell, jr.*, in the chair. After a few preliminary remarks from the chair, reading records, correspondence, and donations, *C. M. Tracy*, of Lynn, described the flora peculiar to this region. There were, he observed, marked peculiarities in the flora of Essex county and a part of Middlesex, which seemed to indicate the influence of the geological formation; examples were cited to sustain this supposition. *George D. Phippen*, of Salem, also spoke on the general subject of botany. He observed that all plants were in some sense wild plants, since those cultivated in one country, grow spontaneously in others. *Messrs. E. S. Morse* and *A. Hyatt* spoke of the various objects found during the previous dredgings, — the first named discussed the mollusca, the other the radiates, and also described the different belts or zones in which animals and plants are found, each having its peculiar species.

Joseph E. Ober, of Beverly Farms, gave a valuable historical sketch of West's Beach. He said that the name was derived, not from the point of compass, but from John West, who held a grant of the place from Salem in 1660. *Rev. A. P. Peabody, D. D.*, of Harvard University; *R. S. Rantoul*, *F. W. Putnam*, *E. N. Walton*, *T. Ropes*, and *H. Wheatland*, all of Salem, made remarks appertaining to the objects of the meeting.

Fourth Meeting at Kittery, Maine, on Thursday, August 21, 1867.—The first meeting outside the limits of the State, and the second held out of Essex county. The principal objects of attraction, aside from the natural history of the place, are the U. S. Navy-yard, and the historical associations; here are to be seen the mansion of Sir William Pepperell, the richest merchant and most extensive land-owner in New England at the time when he won his military reputation at Louisburg, and a baronetcy from the English crown; a portion of this building has been changed, but enough remains to give an idea of its pristine grandeur; also, the Sparhawk mansion, built by Sir William for his married daughter, is elaborately decorated; the Cutts' house, etc., etc.

The afternoon session was held in the stockholder's building of the P. S. & P. Railroad, kindly granted to our use by the President and Directors of the road, and was called to order at 2 o'clock, by Vice-president *Goodell*. Various botanical and zoölogical specimens, culled by the members, were laid upon the table, and the chairman called upon various gentlemen to explain them. *Mr. C. M. Tracy*, of Lynn, discussed the floral, and *Messrs. F. W. Putnam* and *E. S. Morse*, of Salem, the zoölogical. *Dr. Elliott Coues*, of U. S. Army, took for his theme the genus *homo*, or that part of it which is native to Arizona Territory, the Apache Indians, and presented some extended remarks illustrative of their habits and character. *Rev. E. C. Bolles*, of Portland, spoke for the Portland Society of Natural History, and then gave an interesting discourse on microscopic fungi. *Rev. Joseph Banvard*, of Patterson, N. J., responded for a new society, founded on the plan of the Institute. *Rev. George D. Wildes*, of Salem, alluded to the Historical Associations of this place. *James N. Buffum*, of Lynn, and others, addressed the meeting. *Capt. Stephen Decatur*, U. S. N., who is now totally blind, and resides at Kittery, was present at the meeting, and seemed to enter fully into its spirit.

Fifth Meeting at Ipswich, Friday, October 4, 1867.—A charming old town, replete with many old historical associations. On arriving, the party proceeded to the Town Hall, where the baskets were deposited, from which they diverged in various directions, some into the woods, along the banks of the river, and down to the very interesting beach just below its mouth. Some took the Topsfield road, in search of plants and snails; others to "the neck," where some ancient Indian mounds were inspected.

The afternoon session was held in the vestry of the Methodist Church. *Vice-president Goodell*, upon taking the chair, explained the objects of the Society, and briefly recounted its history. *George D. Phippen*, of Salem,

spoke of the flora. *E. S. Morse* described the Indian relics found in the mounds on the neck, also those which he had found at Goose Island, in Portland harbor. He concluded his remarks by describing the manner in which certain of the lower animals eat, illustrating the process with figures on the blackboard.

CHICAGO ACADEMY OF SCIENCES. *Oct.* 8, 1867. — Dr. J. J. Jewell, of the Lake Tunnel, read a report in relation to the geology of the Chicago Lake Tunnel.

Dr. Meyers, of Fort Wayne, Ind., then described the finding of the bones of the Mastodon, presented by him to the academy. He said the locality of the bones was accidentally discovered by a farmer named Trush, who was then digging a drain through one of his fields in Noble county, Indiana. He learned of the discovery and purchased the bones found by the farmer, as well as the right to make farther explorations. In carrying on the investigations he called in the aid of Dr. Stimpson, of Chicago. These two spent several days in superintending excavations, and were rewarded by the accumulation of one of the finest collections of mastodon bones ever found. These evidently belong to three individuals, two adult (probably male and female) and one young one. The skeleton of the calf and one of the adults are nearly complete, and capable of being mounted. They lay at the depth of four or five feet, in a stratum of peat overlaying blue clay, containing lacustrine shells. In the peat among the bones were found fragments of boughs and branches of several kinds of wood, in a good state of preservation, some of which had been gnawed by the beaver. The spot at which the bones were found is a small basin-shaped depression in the middle of a corn-field, which was formerly a willow swamp, and has but recently been sufficiently well drained to allow of cultivation. It is a region where traces of ancient lakes and beaver-dams are particularly abundant.

The size of the adult mastodon has not yet been estimated. That described by Dr. Warren measured seventeen feet in length by eleven feet in height, and it is supposed that the largest of these here described will not fall far short of this in dimensions.

BOOKS RECEIVED.

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* The number for Nov. 30 was never received at this office; will the publishers please mail another copy?
† The number for Dec. 7 was never received.